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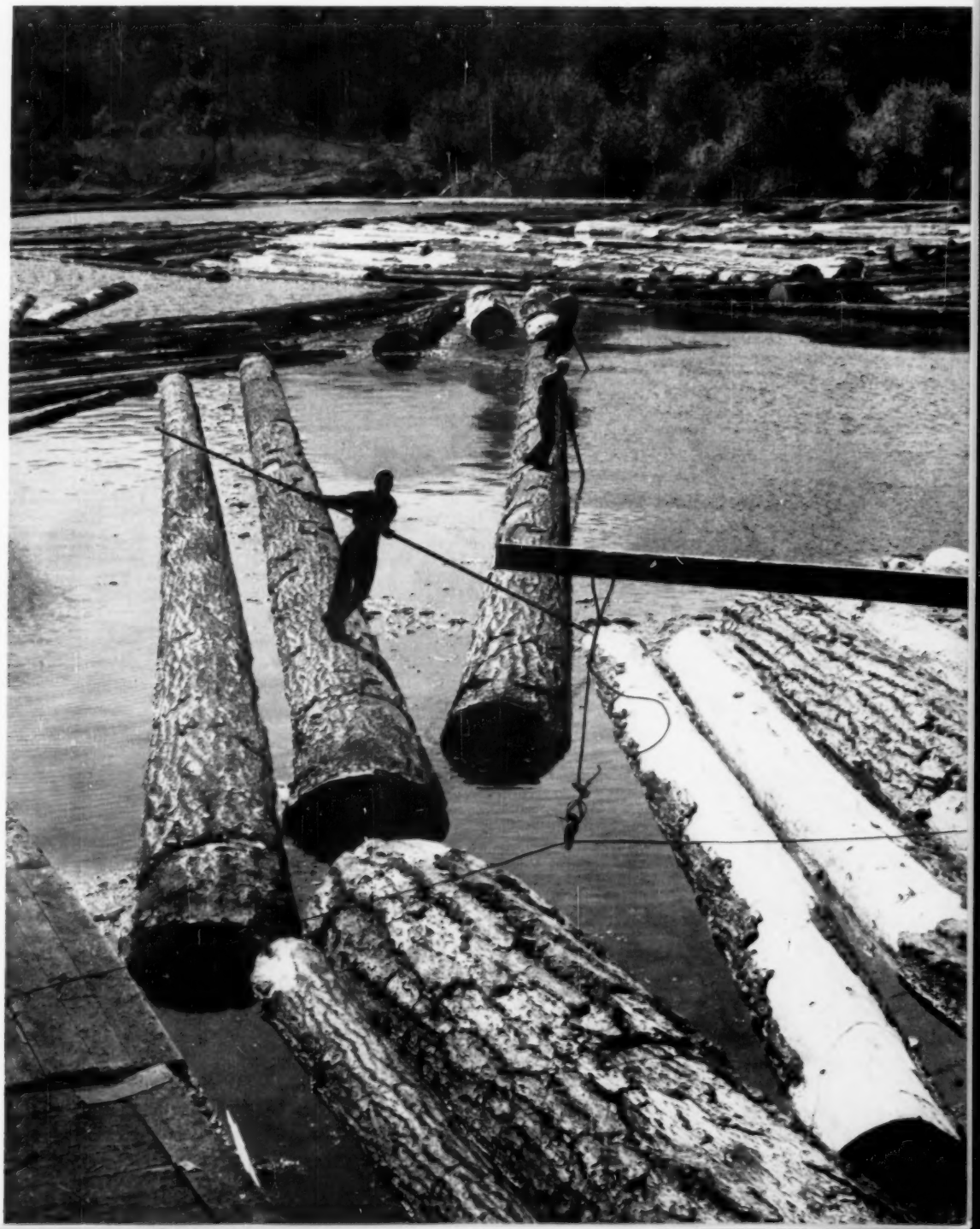

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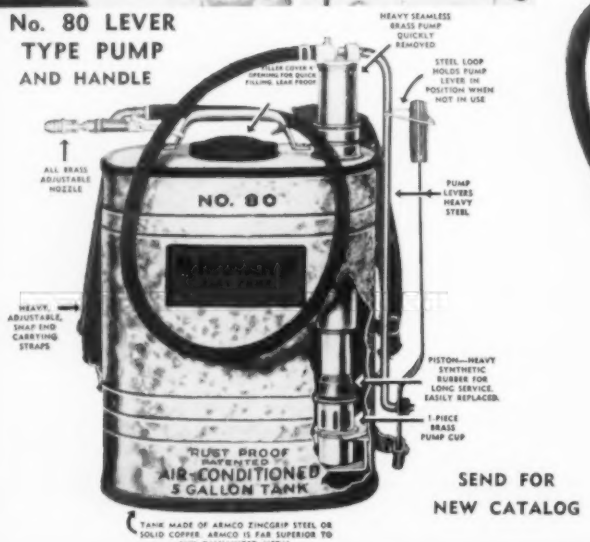
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Photo courtesy American Forest Products Industries

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Journal of Forestry

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Two Methods of Thinning Young Lodgepole Pine in the Central Rocky Mountains

R. R. Alexander
Rocky Mountain Forest and Range Experiment Station[1]
Fort Collins, Colorado

In 1945, study plots were established on the Fraser Experimental Forest in Colorado to evaluate different methods of thinning in young stands of lodgepole pine (*Pinus contorta* Dougl.). Because of the way lodgepole stands developed and because of their watershed value in the Rocky Mountains, thinning here presents several special problems.

Unlike most other species, lodgepole pine may retain viable seed in unopened cones on standing trees for a considerable period of time (*7*). In the Rocky Mountains such seed may remain viable for 30 years or more. After cutting, or after some form of natural devastation such as fire, has killed all or part of the overstory, cones open and release seed. The combination of abundant seed, adequate seed bed preparation, and favorable climatic conditions result in a prodigious number, often 10,000 to 100,000 seedlings per acre (*2*). The majority of these are established within the first 5 years. When spared from fire and other destruction, these seedlings develop into dense sapling and pole stands.

Intensive competition for limited soil moisture on the relatively poor sites of the Rocky Mountains does not permit good growth in such dense stands. Lodgepole pine, although an intolerant tree, will not thin itself naturally. Severe crowding of young trees of the same age or size results in the stagnation of growth. Even when crown classes are rather distinct, too many trees persist; therefore artificial thinning is needed.

Another reason for thinning in overcrowded stands is to increase streamflow. It has been demonstrated on the plots used in this study, that openings made by thinning will significantly increase the amount of net precipitation (mostly snow) reaching the ground without materially increasing the loss of soil moisture or impairing the quality of water (*1*). From these results it was concluded that under similar forest conditions thinning young lodgepole pine will increase the amount of water available for streamflow.

The question is not whether to thin, but what kind of thinning is economically and silviculturally justified.

Review of Other Work

Practically all of the cutting in lodgepole pine has been in old-growth timber. Silvicultural interest has, therefore, been directed toward harvest cutting and reproduction. Thinning studies in the central Rocky Mountain region have been limited and sporadic. The first reported thinning was a uniform area spacing study made on small test plots in southeastern Wyoming in 1909.[2] Similar test plots, scattered throughout Colorado and Wyoming were thinned from 1911 to 1933. Because of the variation in degree of thinning, sites, stand conditions, and time since thinning, the data from these plots can be summarized only in a general way. They show that thinning increased the rate of diameter growth. Acceleration of diameter growth was greater on the heavily thinned plots; cubic volume and basal area growth were greater on the lightly thinned plots.

Much thinning was done during the time of the Civilian Conservation Corps, when it is estimated some 90,000 acres of lodgepole pine were treated. These thinnings reserved dominant and codominant trees in a uniformly spaced pattern, usually 6 by 6 feet to 10 by 10 feet apart, depending upon tree height (*8*). Increment borings made in one of these stands on the Roosevelt National Forest in Colorado showed that for a period of 11 years after thinning the rate of diameter growth of dominant trees doubled and that of intermediate trees was increased 3 times (*6*).

Studies at Pringle Falls, Oregon, showed that lodgepole pine will respond favorably to thinning (*3*). Here, diameter increment on thinned plots was from 1½ to 2½ times as great as on the unthinned plots during the first 12 years after thinning.

A thinning study in a 77-year-old stand on the Kananaskas Forest in Alberta, Canada, showed that heavy thinning, removing 70 percent of the cubic volume, greatly accelerated growth (*4*).

All these studies show that thinning will stimulate growth, but their application is limited because: (1) no attempt was made to compare different methods of thinning under similar stand conditions, and (2) there was no reported use of the crop tree method of thinning.

The Fraser Study

The study reported here was conducted on six 2¼-acre blocks in the main valley of the Fraser Experimental Forest, between elevations of 8,800 to 9,000 feet. The original forest of lodgepole pine and spruce-

[1]Forest Service, U. S. Department of Agriculture, with headquarters at Colorado A & M College.

[2]Roeser, J., Jr. 1936. Growth of lodgepole pine in the central Rocky Mountains. Rocky Mountain For. Range Exp. Sta. Progress Report (typed).

TABLE 1.—EFFECT OF DIFFERENT THINNING METHODS ON BASAL AREA GROWTH[1]

Treatment	Basal area			
	Pre-treatment (1943)	Post-treatment (1946)	Post-treatment (1953)	Mean annual increment (1946-53)
	Square feet			
Unthinned	87.57	[2]97.76	121.89	[2]3.43
Crop tree	85.69	49.57	72.19	3.23
Single tree	87.86	33.57	57.70	3.47

[1]Basal areas of trees 0.5 inch in diameter and larger.
[2]No tally by diameter classes was made on the unthinned plots in 1946. Values were obtained from a straight line interpolation between 1943 and 1953.

TABLE 2.—EFFECTS OF DIFFERENT THINNING METHODS ON CUBIC FOOT VOLUME GROWTH[1]

Treatment	Volume			
	Pre-treatment (1943)	Post-treatment (1946)	Post-treatment (1953)	Mean annual increment (1946-53)
	Cubic feet			
Unthinned	1,031.30	[2]1,235.84	1,718.17	[2]68.71
Crop tree	1,002.96	606.65	959.11	50.32
Single tree	1,035.37	445.33	803.09	51.10

[1]Cubic volume of trees 0.5 inch in diameter and larger, entire stem less bark.
[2]No tally by diameter classes was made on the unthinned plots in 1946. Values were obtained from a straight line interpolation between 1943 and 1953.

fir was cut over in 1910 and then burned. A large area came in to dense second-growth logepole pine, which at the time of thinning averaged about 35-years old.

The individual blocks sample a wide range of site conditions. Slopes vary from 2 to 25 percent; and aspect embraces all compass directions. Original stand density was between 2,580 to 7,300 stems per acre, with an average of 4,200. Basal area was less variable. The maximum was 103.3 sq. ft. per acre; the minimum, 55.8 sq. ft; and the mean, 87.0 sq. ft. Soils were developed from coarse textured glacial outwash.

The blocks were divided into three ¼-acre plots, each surrounded by a 35-foot isolation strip that received the same treatment as the plot. Treatment was randomly assigned. One plot in each block was left unthinned as a control; the remaining two were thinned by different methods.

Thinning Treatments

Two kinds of thinnings were made. One, designated as single tree, was a complete or uniform area thinning in which cutting was done in all parts of the stand. This was principally a low thinning that reserved an average of 630 of the better dominant and codominant trees per acre, spaced about 8.5 feet apart. All other trees were cut.

The second method was a crop tree thinning. Competing trees were cut only around selected dominant or codominant trees. Openings about 16 feet in diameter were made around each of approximately 100 trees per acre, spaced 21 feet apart. The remaining, or fringe trees outside the cleared circle surrounding each crop tree were left standing. Selection of crop trees was based upon their apparent growth potential, with spacing a secondary consideration.

Thinning was completed on all plots in 1945. Basal area per acre was reduced 42 percent on the crop- tree plots, and 62 percent on the single-tree plots; number of stems per acre was reduced 52 and 84 percent, respectively.

Growth Response

Two methods of determining the growth response to release were used. The first (the total stand method) has been described elsewhere by Thorne.[3]

Total stand method.—Thorne made a comparison of the growth of all trees in the stand during a period of 7 years after treatment, and showed all diameter classes were about equally stimulated by both kinds of thinning. Mean annual diameter growth per tree on the single tree plots was 3 times greater than that for all trees on the unthinned plots; on the crop trees alone, growth was 5 times greater. But when crop and fringe trees were combined, growth per tree on the crop tree plots was only slightly greater.

Table 1 gives basal area data for different treatments as computed by Thorne. He found that mean annual basal area growth per acre on thinned and unthinned plots was not significantly different, despite the fact that both thinning methods heavily reduced average basal area per acre.

Cubic-foot volume figures from the same source are given in Table 2. Mean cubic volume growth per acre was significantly greater on the unthinned plots, but stand increment on the thinned plots was concentrated on fewer and better quality stems. There was no significant difference in volume growth between single tree and crop tree thinning.

Comparable tree method.—Comparing the average rate of growth for all trees exaggerates the benefit of thinning, because the removal of suppressed and slow growing trees automatically raises the average rate of growth regardless of the effect of thinning. Selection of trees of comparable size and condition in the thinned and unthinned stand is a fairer comparison (5). A second method of determining thinning response was based on this concept.

In the fall of 1953 trees were selected from each of the single tree and unthinned plots to correspond with crop trees in number, spacing, and apparent health. The crop trees on the crop-tree plots and trees selected to correspond with them on the other plots were tagged, and increment borings were made at breast height. A total of 492 trees, 164 in each treatment, was involved (this amounts to about 100 trees per acre).

Mean diameter of tagged trees on the crop-tree plots was 4.8

[3]Thorne, T. 1954. Growth aspects of thinned young lodgepole pine. A thesis submitted in partial fulfillment for a degree of Master of Forestry. School of Natural Resources, University of Mich. (typed).

inches; on the unthinned plots 5.0 inches; and on the single-tree plots, 5.4 inches. The average diameter of trees on the individual plots did not vary more than one diameter class from the treatment mean. As eight growing seasons had passed since thinning, comparative ring count and growth measurements were made at 8-year intervals before and after thinning.

Prior to thinning, average annual diameter growth of tagged trees on the single-tree and unthinned plots was 0.10 inch. Crop trees were growing at an average rate of 0.09 inch per year (Table 3). There were significant differences in the rate of diameter growth between blocks, but differences within individual blocks appeared negligible.

After thinning, tagged trees on all treated plots showed a definite response to release. This was apparent the first year and continued throughout the 8-year post-treatment period. Diameter increment of the best 100 trees per acre on the single-tree plots was about 2 times as great as that of comparable trees on unthinned plots; on the crop-tree plots diameter growth was 1½ times as great. In inches, average annual diameter growth on single-tree plots increased to 0.15 and on crop-tree plots to 0.12. At the same time, diameter growth on the unthinned plots decreased to 0.08 inch per year.

Differences in growth response between the two types of treatment was significant at the 1 percent level, and remained significant at that level after the variation of pretreatment growth rates had been eliminated by covariance analysis.

The eventual benefits of thinning can be roughly estimated by calculating the years required, following thinning, for the average of the best 100 trees per acre to reach merchantability (10-inch diameter class). If the initial rate of growth continues time requirements would be as follows:

Thinning treatment	Years after thinning	Total age
Single tree	38	73
Crop tree	46	81
None	64	99

TABLE 3.—AVERAGE ANNUAL DIAMETER GROWTH OF TAGGED TREES, 8 YEARS BEFORE AND 8 YEARS AFTER THINNING

Block no.	No. of trees per plot	Single tree		Crop tree		Control		Average for Block	
		Before	After	Before	After	Before	After	Before	After
		Inches							
1	26	0.14	0.17	0.10	0.12	0.11	0.09	0.12	0.13
2	26	.08	.13	.08	.12	.08	.07	.08	.11
3	26	.13	.18	.13	.15	.15	.10	.14	.14
4	28	.09	.16	.07	.11	.09	.08	.08	.12
5	31	.07	.11	.07	.11	.06	.05	.07	.09
6	27	.08	.13	.09	.12	.09	.07	.09	.11
Ave. for the treatment		.10	.15	.09	.12	.10	.08	.10	.12

Discussion and Conclusions

The larger initial response from single-tree thinning may be due largely to the reduction in number of stems per acre, causing a decrease in competition for soil moisture. Openings around tagged trees were about the same size in both treatments, but the single-tree plots averaged only 630 stems per acre compared with an average of 2,072 crop and fringe trees per acre on the crop-tree plots.

The crop-tree plots would not be thinned again under management. Crop tree thinning was intended as a less expensive, one-time operation when no market exists for small round products and stands must be thinned to prevent early stagnation. Crop trees should maintain their present rate of growth for sometime because only 100 trees per acre have been fully released. Openings were designed to be large enough to prevent individual crop trees from being overtopped by the intervening fringe trees. Crop trees were spaced far enough apart to reach merchantable size before they begin to compete with each other. Some increased competition for soil moisture will result from the unintended release of surrounding fringe trees. However, growth will be concentrated on the crop trees, and fringe trees will furnish little more usable material than similar trees on the unthinned plots.

In contrast, single-tree thinning has maintained uniform stand dominance by fully releasing all 630 trees per acre. As these trees grow their crowns will close in, resulting in increased competition for available soil moisture. The best 100 trees per acre may not reach merchantable size before the benefit of thinning begins to diminish. Under management, a second thinning may be desirable before the final harvest.

The potential total yield is probably greater under single-tree thinning, despite the fact that there are fewer trees per acre, because growth is concentrated on a larger number of fully released dominants and codominants. However, this method is more expensive to apply because more trees must be removed, and extra time is needed to select the trees to be reserved. This disadvantage may be partially offset if additional thinnings are made, because then trees that fail to develop satisfactorily or suffer unpredictable damage from disease and insects can be eliminated; and the stems brought to final harvest will be uniformily of the highest quality.

Considerably more data on stand development in relation to stand density are needed before exact calculations can be made of the time required for trees on thinned plots to reach merchantability. This lack of knowledge does not, however, invalidate the conclusion that thinning by either the single tree or crop tree method has an economic advantage of shortening rotations, and concentrating stand growth on quality stems that will produce the final crop.

The production of water of high quality is as important as increased growth and shortened rotations when considering the management of young lodgepole pine. Goodell showed that both types of thinning described here increased the amount of net precipitation reaching the forest floor by about 20

percent. But he found no significant differences between the two methods of thinning, indicating that they were about equally effective in increasing the amount of water available for streamflow.

Shortened rotations and increased yields are potent arguments in favor of thinning; but in the final analysis, the actual choice of the kind of thinning to be done commercially will be determined largely by economic conditions. The single-tree method is appropriate when the material removed can be sold, or when the extra cost of this method can be regained at the time of saw-log harvest through earlier and large stumpage returns. At present, there are no markets for small lodgepole pine in the central Rocky Mountain region, and the stumpage value of mature pine is low. Thinning must be done as cheaply as possible, probably a one-time operation only, since all the cost must be charged to trees removed in the saw-log harvest. Under these circumstances the crop-tree method offers the best opportunity of bringing young lodgepole pine stands under management.

Summary

Two methods of thinning 35-year-old lodgepole pine on the Fraser Experimental Forest are examined: (1) "Single tree" that cut all but 630 trees per acre, spaced 8.5 feet apart; and (2) "Crop tree" that cut openings 16 feet in diameter around the best 100 trees per acre, and left standing the trees outside the cleared circle. Eight years after treatment, comparisons of average diameter growth were made between the 100 crop trees on the crop-tree plots and 100 similarly selected trees on the single-tree and unthinned plots.

Although single-tree thinning showed better initial growth, it is more expensive to use because more trees must be cut, more time spent selecting leave trees, and the treatment may have to be repeated. Crop-tree thinnings are, therefore, recommended where small trees cut cannot be sold and the whole cost of thinning must be recovered through increased stumpage values at time of final harvest.

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Factors Affecting Small-Woodland Management In Nacogdoches County, Texas

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THE PINEY WOODS of Nacogdoches County, in east Texas, were the setting for a recent study that suggests some answers to the perennial question: Why do some small landowners practice forestry while the great majority fail to do so?

The Study Area

Nacogdoches County occupies 616,320 acres of central east Texas. The population, 30,326 by the 1950 Census, is predominantly rural; 60 percent of the inhabitants are on farms or in villages of less than 1,000 people.

Two-thirds of the county is forested. In 1953 the U. S. Forest Survey found that about 29 percent of the forest was in farms, 42 percent in nonfarm individual holdings, 3 percent in estates, 25 percent in the hands of forest industry, and less than 1 percent in national forest.

Of the total 409,500 forest acres, three-fourths are in small ownerships—i.e., individual holdings under 5,000 acres. According to the 1950 Census of Agriculture, the average farm woodland contains 84 acres.

Practically all of the forest is loblolly and shortleaf pine in mixture with low-grade upland hardwoods (SAF type 80). Table 1 shows average stocking of the various private ownerships. The small holdings are grossly understocked, having about 725 board feet of pine per acre. This is less than ¼ the stocking on the industrial forests, which, though they still show the effects of past overcutting, are currently setting the pace for good private management in the county. These holdings are part of 5 large ownerships—3 lumbering enterprises and 2 pulp and paper companies—that extend into adjacent counties.

Much effort has been expended on promoting forestry in Nacogdoches County. During the past 30 years, the Texas Forestry Association, the Southern Pulpwood Conservation Association, the Texas Tree Farms System, and the East Texas Chamber of Commerce have provided education and publicity, backed up by substantial inducements such as prizes, free planting

[1]East Texas Research Center, maintained in cooperation with the Stephen F. Austin State College, Nacogdoches, Texas.

stock, and organized training camps.

Among the public agencies, the Texas Extension Service, working directly with farmers and 4-H clubs, has long promoted forestry. Agricultural teachers have trained members of Future Farmers clubs in applied forestry. At Nacogdoches is the Stephen F. Austin State College, offering professional training in forestry. Here also is the headquarters of the Southern Forest Experiment Station's East Texas Research Center, which operates 2,600 acres as an experimental forest within Nacogdoches County.

Since the early 1930's, the Texas Forest Service aided by the U. S. Forest Service, has maintained an increasingly effective organization for detecting and suppressing fires. In recent years, a federal-state cooperative project (under the Cooperative Forest Management Act and prior legislation) has provided technical assistance to woodland owners. The Agricultural Conservation Program, like its predecessors, offers farmers incentive payments to plant trees and improve woodlands. In the 1930's, the U. S. Soil Conservation Service provided direct forestry assistance to landowners by utilizing the manpower of the Civilian Conservation Corps. This agency still offers technical assistance in planning and conducting forestry work.

It seems fair to conclude that landowners of Nacogdoches County have had at least as much opportunity to become acquainted with forestry as have owners in most other areas.

Study Methods

As a first step, a 10-percent sample of small landowners, by name and acreage held, was taken from county tax rolls. The occupations of these owners, and the presence or absence of woodlands on their properties, were determined from interviews with 41 community leaders in various parts of the county. The community leaders were also questioned as to local attitudes toward forestry. Finally, they were asked to name individuals whom they considered to be practicing forestry.

Forty individuals were mentioned as taking a tangible interest in their timber. This number is not necessarily complete, but it probably is nearly so. Even among these, half failed to meet study standards of good management, which required the owner to do substantial planting or improvement cutting, or to take fire protection measures of his own for at least two years. From the remaining 20, eight were selected as representative of the better forest managers in the county. Their tracts had been under management since at least 1946.

The selected owners were interviewed and their timber resources appraised. To evaluate average management, examinations were made of 8 other forest properties drawn from the tax list.

Results

The tax-roll records and the interviews with community leaders indicated that 50 percent of the county's small-tract owners are farmers and 43 percent are nonfarmers. Seven percent of the holdings are unsettled estates. Woodlands occurred on 75 percent of the farms, 80 percent of the nonfarm holdings, and 86 percent of the estates. Among ownerships containing woodlands, the farm and nonfarm holdings averaged about the same gross area—136 acres. The estates averaged 168 acres. Table 2 summarizes the holdings by occupation classes.

The 8 better managed properties were chosen to represent, insofar as possible, the proportion of occupational groups in the county. The farm group consisted of 3 dairymen and one cattleman who, in ad-

TABLE 1.—STOCKING PER ACRE OF PRIVATE WOODLANDS IN NACOGDOCHES COUNTY, 1953.[1]

Ownership class	Pine	Hardwood	Total	Pine	Hardwood	Total
	Board feet[2]			*Cublic feet*[3]		
Small ownerships						
Farm	787	735	1,552	213	284	497
Nonfarm	681	526	1,207	209	213	422
Forest industries	3,462	603	4,065	676	261	937

[1]Source: Forest Survey, U. S. Forest Service, 1953.
[2]International rule, ¼-inch kerf. Trees larger than 9.5 inches in d.b.h.
[3]Trees larger than 3.5 inches in d.b.h.

TABLE 2.—AVERAGE SIZE OF OWNERSHIPS OF 15-5000 ACRES, BY OCCUPATION CLASSES, NACOGDOCHES COUNTY, TEXAS

Occupation	Holdings with timber		Holdings without timber	
	Number	Average size	Number	Average size
		Acres		*Acres*
Farming				
General	115	121.3	38	47.8
Livestock	19	211.7	—	—
Dairy	22	217.1	14	152.1
Housewife	20	82.0	13	35.2
Retired	22	125.4	—	—
Nonfarm				
Business	68	149.9	12	68.7
Laborer	40	81.3	—	—
Professional	16	202.4	2	66.0
Retired	5	146.4	—	—
Housewife	33	162.1	12	55.9
Miscellaneous	15	82.7	19	35.1
Estates	32	180.6	5	83.8
All classes	407	139.9	115	62.4

Basis: Ten-percent sample of tax records and interviews with community leaders.

TABLE 3.—AVERAGE ACREAGE IN 16 STUDY TRACTS

Ownership class	Better managers	Average managers
	Acres	
Farms		
Forest	94	31
Total	277	74
Nonfarm		
Forest	1,219	250
Total	1,387	296

TABLE 4.—STAND CONDITIONS PER ACRE ON 16 STUDY TRACTS

Management class	Basal area[1]		Pine stocking[2]	Pine volume	
	Pines	Hardwoods			
	Square feet		*Percent*	*Cu. ft.*[3]	*Bd. ft.*[3]
Better woodlands	44	34	54	665	1,713
Average woodlands	19	38	23	213	515

[1]Trees more than 3.5 inches in d.b.h.
[2]Proportion of sample points stocked.
[3]International rule, ¼-inch kerf. Trees larger than 9.5 inches in d.b.h.

dition to maintaining improved pastures, grow part of the grain required for supplementary feed. All four operate their own farms. The nonfarm group was made up of a businessman, a college professor (not a forester), and a pulpwood producer. One estate, handled by a full-time manager, made up the eighth property.

The average woodlands fell into the same representative pattern. The farm group included two general farmers and two cattlemen. The nonfarmers were a barber, a mechanic, and a former sawmill operator; the latter two were not residents of the county. An estate was not under a full-time manager.

The better managers derive most of their income from sources other than their woodlands. None appeared pressed for operating capital, and all had excellent retail credit ratings.

The better managed properties averaged 832 gross acres, with 656 in forest. They were therefore nearly six times the size of the average small holding in the county (140 acres; see Table 2). Table 3 compares the gross acreage and the forest acreage of the 16 study properties.

Two of the better managed farm forests had been in the same families for three and five generations, and were about the best stocked tracts in the study. The newest farm ownership was acquired in 1941, for dairying. The three older farms were originally in row crops, but have since been converted to livestock enterprises.

The better managed nonfarm holdings were acquired more recently than the farms. The pulpwood producer inherited over half of his tract but bought three more units, primarily for timber production, during the last 12 years; he now owns 682 forested acres. The businessman's 353 wooded acres were obtained in 1935 and 1944 in settlement of debts. The college professor began buying his lands (largely abandoned farms) in 1945, specifically as a forestry venture. The 3,200 acres of estate lands are all forest. They were acquired between 1900 and 1927 in 30 separate tracts by the father of the present manager.

Comparably detailed data were not available on the 8 tracts typical of prevailing management. Most of them were inherited or purchased as farms.

Forestry beginnings on the better managed woodlands. — The earliest forest management started in 1935 and 1937, when two of the farmers undertook forestry on land that was unprofitable to cultivate. The SCS helped plan the work, and the CCC furnished labor. Stand improvement, selective marking, and planting of pines and black locust were done on one tract. On the second farm, management was limited to planting 48 acres of pine over a period of several years.

In 1940, with SCS assistance, another farmer placed his woodland under management. SCS has continued to help him, and he has received aid from an industrial forester. The fourth farm forest was selectively marked by the SCS in 1946 but has subsequently been handled largely by the owner.

The estate was put under management in 1941, in connection with the Nacogdoches County Farm Forestry Project. The Texas Forest Service and the SCS helped initiate management on the other three nonfarm tracts in 1945 and 1946.

It is noteworthy that technical foresters inspired the work on all eight tracts and have rendered continuing assistance on most of them.

Condition of woodlands. — Volume and basal area on the 16 study tracts were measured by the variable-plot-radius procedure.[2] The better managed woodlands were sampled at a total of 197 points and the average tracts at 153 points. Pine stocking was estimated on circular milacres having the sample point as center. A milacre was considered stocked if it was occupied by a pine 1 inch or larger in d.b.h. or if it was more than 50 percent shaded by a pine crown.

The better managed forests had over twice as much pine basal area and more than three times as much cubic and board-foot pine volume per acre as the average tracts (Table 4).

Among the better managed tracts, the farm and the nonfarm forests had about the same cubic volume per acre, but the nonfarm group had three times as much saw-log volume (2,721 board feet per acre of pine and hardwood as contrasted to 878 on the farms). On the other hand, farm owners had stimulated better stocking of seedling and sapling pines by more frequent saw-log cuts and farm use of competing hardwoods. Thus the farm woodlands, while currently containing a smaller investment in merchantable growing stock, have equal if not better earning prospects for the years ahead.

Among the better managed tracts, half were last cut in 1954, three in 1953, and the eighth in 1950. Annual harvests are made on the estate, and two of the farms take out fence posts and farm lumber each year. One farmer has made saw-log cuts at 5- to 6-year intervals since 1935. In general, the farmers consider their woodlands as an integral part of their farm, supplying lumber, posts, and cash. Too, they have found woods work to be a profitable use of their time. One farmer personally produces and hauls pulpwood and saw logs to market. Another owns and

[2]Grosenbaugh, L. R. Shortcuts for cruisers and scalers. U. S. Forest Serv. South. Forest Expt. Sta. Occas. Paper 126, pp. 2-8. 1952.

operates a small sawmill for cutting his farm lumber. All produce most of their own fence posts, and one treats his posts with pentachlorophenol by cold-soaking.

Two of the nonfarm owners take an active part in planting trees, marking timber, and supervising cutting.

In the average woodlands, cuttings were much heavier and less frequent than in the better managed group. Two average tracts produced income in 1954, and each of the others was cut once between 1946 and 1953. All of the average owners have derived income from their woodlands, but they cut so severely that none of them will be able to make another substantial cut at any time soon.

The need for controlling low-grade hardwoods was great in all 16 woodlands. The average managers had done no stand improvement work and did not seem aware of the need for it. Among the better managers, three had deadened some of their worthless hardwoods, though not recently, and most of the rest were cognizant of the value of such work.

Local thoughts on forestry.—The 41 community leaders emphasized that higher stumpage prices following World War II have been the greatest single factor in stimulating interest in timber as a crop. The persistent offers of sawlog and pulpwood buyers have convinced practically all timber owners that trees, particularly pines, are valuable. Nevertheless, the concensus was that most owners are still not practicing forestry, nor were they thought to be in position to do so. The most frequently mentioned obstacles to forestry were ignorance, inertia, time required to grow a tree crop, and urgent money needs. Indeed, to owners with limited capital, market pressure has become as much of an obstacle to forestry as lack of outlets and low prices used to be.

Over-cutting is often rationalized as a step toward clearing land for pasture, but followup measures are seldom taken. The result is that the woodlands continue indefinitely as brush-covered waste areas unproductive of either timber or grass. It is doubtful that many small landowners could be inspired to undertake the formidable task of brush control and planting that would be needed to convert such tracts to pine.

The community leaders were aware of the efforts of public and private foresters to promulgate timber management in the county. Many of them mentioned a particular SCS forester who worked in the county from 1940 to 1946 and was unusually effective in persuading landowners to manage their trees.

Conclusions

After at least 25 years of forestry promotion, small landowners of Nacogdoches County, Texas, are still in the beginning stages of forest management. The county does not lack for woodland owners who have dabbled in forestry at one time or another, but sustained programs are still rare.

This study indicated that landowners who undertook timber management did so on properties that were reasonably well stocked. Further, these owners derived substantial income from sources other than their woodlands and therefore were not pressed to cut immature growing stock. Their total landholdings (forest and nonforest) were six times the average ownership in the county. In general, they were forward-looking, progressive men, successful in farming or business and respected in their community.

Even with these advantages, they did not undertake management until professional foresters encouraged them to do so. Nearly all of them have received continuing assistance from public or private foresters.

It would appear that landowners in this area must be induced to practice forestry while they still have pine timber to work with. Once their woodlands have been reduced to a sea of hardwood brush, most owners shrink from the long waiting period necessary to rebuild desirable growing stock. It also seems that forestry programs can most fruitfully be directed toward owners with better than average assets, acreage, and timber growing stock.

COMING UP

In March: Dean S. T. Dana tells of the 80 year history of the American Forestry Association and its influence on American forestry.

In April: How does a banker view forest credit?

An Early Test of Levels of Growing Stock in Appalachian Hardwoods

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AFTER THE BEST virgin hardwoods of the southern Appalachians had been cut out, there came a difficult period of transition which still continues. The supply of second-growth material is as yet scarcely sufficient to support the timber industries; moreover, logs are smaller, grade yields lower, and costs of producing lumber higher. Most of the larger trees in the partially cut old stands are defective and deformed. Ideally, they should be removed in heavy salvage cuts. But many foresters and timbermen believe they should be harvested gradually in order to "sweeten the cut" of new growth and allow some of it to grow larger. As a guide to some compromise between these two views, we need information on growth per acre and regeneration obtained in response to amount and type of growing stock left after different degrees of cutting in old-growth stands. Such information was sought in a study on the so-called Long Branch Plots of the Bent Creek Experimental Forest in western North Carolina on the Pisgah National Forest. Here a range of initial formative cuts in old-growth forest was made in 1936. Effect on reproduction was studied 7 years later, and on growth and yield 15 years later.

Literature

The best form of forest for sustained-yield management of hardwood, whether even-aged or all-aged, is still an open question. Kernan (*9*), reporting his experience with northern hardwoods in central New York, says the selection system does not work well, that "overleaving" causes more deterioration than over-cutting. He maintains that, except for hemlock and beech, reproduction under partial cutting is unsatisfactory. Zillgitt (*16*), in the Lake States, finds the selection system well suited to northern hardwoods. The system chosen must provide the regeneration needed. While there is no urgent need to resolve this fundamental problem, there is need for information that will contribute to an ultimate solution. A previous study on Bent Creek (*14*) indicated that partial cutting with reserved trees selected for quality is a promising method of preparing typically decrepit stands for continuous systematic management.

Cuttings variously affect species composition of reproduction, its origin from seeds or sprouts, and the regeneration period. According to Tryon and Finn (*13*), adequate restocking required 16 years in New York in mixed hardwood forest where, as on the Bent Creek area, red and chestnut oaks were predominant. In Connecticut, Averell (*1*) compared the sprout capacity of several species present at Bent Creek. He found no red maple or chestnut oak stumps failing to sprout. Among others of our species there was increasing failure as follows:

	Percent
Red oak	9.5
White ash	11.3
White oak	11.4
Scarlet oak	17.2
Black oak	32.3
Hickory	41.8
Sweet birch	66.1

In the Appalachians, sprouts of these species tend to outnumber the seedlings on areas where the trees are cut on short rotations for pulpwood only. Despite the initial advantage sprouts have in height growth, they do not surpass seedlings at 6 years of age. An early study (*2*) showed that the reproduction of the less desirable species on moist sites was 44 percent and on dry sites 74 percent of total reproduction. The percentage of reproduction free to grow that consisted of less desirable species was as follows by sites: moist 36, slope 66, and dry 76. Thus the preferred reproduction predominates on the best sites. In general, Frothingham (*7*) found the desirable species more than holding their own in the new growth on cutover Appalachian areas.

Some form of partial cutting is much better adapted for the regeneration of oaks by seed than is the seed-tree method according to Downs and McQuilkin (*4*) for these reasons: (1) most acorns are not dispersed far from the parent tree, and are subject to destruction by various agents, (2) an overhead canopy and the litter on the forest floor reduce the desiccation of acorns, and (3) as elements of the climax types of vegetation the oaks are not generally subject to replacement under partial cutting. If the seed tree method must be used they suggest that 10, or preferably 20, seed trees per acre be retained for litter and shade. This would involve residual stand volumes ranging from 1,500 to 2,500 board-feet per acre.

Growth and yield in the present experiment were similar in several respects to the growth of more northern forests reported in the literature.[1]

Mean annual growth of upland oaks at 80 years in the Appalachians, for example, is reported by Schnur (*12*) to be 196 board feet for fully stocked stands on site 60, and by Frothingham (*7*) to be 186

[1] In this paper and in the literature review, volumes given in cubic feet are for all merchantable trees to a 4-inch top outside the bark. Unless otherwise specified, basal area data are for all trees 3.6 inches in d.b.h. and larger. Board feet are based on the Scribner log rule to merchantable tops, except those quoted from Gevorkiantz (Int. ¼-inch rule), and those from Schnur (Int. ⅛-inch rule) to a 5-inch top inside bark and including all trees having at least one 16-foot log. Frothingham and Zillgitt's estimates were by the Scribner Decimal C rule and for all trees 10 inches in d.b.h. or larger. In the Bent Creek experiment pulpwood included all trees larger than 3.5 inches and below saw-log size, which was 10.6 inches and larger for yellow-poplars and 12.6 inches and larger for other species. For other "yard-sticks" see section on changes in size-class distribution and Table 5.

board feet for second growth on sites of like quality. These observations match the maxima observed by Gevorkiantz (*8*) for southwestern Wisconsin. He reports normally stocked oak farm woods varying in growth from 47 board feet per acre for sites of very poor quality to 180 board feet per acre for very good sites.[2]

Although optimum stocking for timber growing has not been precisely determined, it is likely to be well below the level of fully stocked stands. In the Bent Creek experiment the initial board foot volume for 30 percent stocking was 3.4 M (Table 1). For northern Michigan, Zillgitt (*15*) reports that a corresponding residual volume, 3.5 M board feet gave a higher rate of earning (3.6 percent value growth) than any other stocking. This was for a basal area of 44 square feet, and a cutting cycle of 15 years.

According to Schnur (*12*) the mean annual growth of upland oaks for site 60 peaks at 47 cubic feet between 60 and 80 years in full stands. He also shows that half-stocked areas yield 2,085 cubic feet on site 60 at 80 years, a mean of 26 cubic feet annually.[3]

Owing to the growing-space requirements of small trees serving as recruits for larger ones, the average acre of a forest organized for sustained yield cannot be as heavily stocked as are many individual acres fully stocked with the larger sizes only. Using a summation formula that recognizes this need in managed forests, Meyer and Keller (*10*) computed from Schnur's yield tables and from stock tables of balanced forests in Pennsylvania the indicated normal forest stocking in cubic feet. They concluded that on average or good sites 1,800 to 2,400 cubic feet should be maintained per acre of upland oak. The average stand in the present experiment, containing 3.4 M board feet, or 1,130 cubic feet (30 percent stocked according to Table 1) is on Meyer's basis for continuous yield, one-half to two-thirds stocked.

The literature also indicates what diameter growth may be expected from our species in other localities. Ten-year growth as related to tree size in natural saw timber stands was observed in the anthracite region of Pennsylvania by Ferree (*6*). He reports yellow-poplar and red oak making their best growth in the 14-inch to 16-inch classes, where they grew about 3 inches in 10 years. Comparable sweet birch and red maple trees also did best at that size, but were growing only half as fast.

TABLE 1.—VOLUMES PER ACRE AFTER CUTTING IN 1937 IN RELATION TO DENSITY OF STOCKING

Stocking in 1937[1] (Percent)	Basis: number of plots	Gross volume		Volume of saw-log trees Scribner		
		All sizes over 3.6 in.	Saw-log sizes only[2]	All species	Desirable species only[3]	
		Cu. ft.	*Cu. ft.*	*M bd. ft.*	*M bd. ft.*	*Percent*
10	5	210	30	0.2	—	—
15	5	320	140	1.0	1.0	100
20	8	540	320	1.7	1.7	100
25	10	840	560	2.6	2.5	97
30	7	1,130	850	3.4	3.2	94
35	5	1,440	1,150	4.2	3.8	91
40	3	1,780	1,470	5.0	4.4	88
45	2	2,120	1,800	5.8	4.9	85
50	2	2,460	2,150	6.5	5.8	90
55	3	2,840	2,510	7.2	5.1	71

[1]A stand density index of 232 represents 100 percent stocking. An index for each plot was computed by Reineke's method using Schnur's formula for upland oak forests. U. S. Dept. Agric. Tech. Bul. 560, 1937. Above figures are read from curves based on 50 one-acre plots. The data for the five most heavily stocked plots are weak.

[2]Saw-log size includes yellow-poplars 10.6 inches in d.b.h. and larger, and other species 12.6 inches and larger.

[3]Desirable and less desirable species are listed separately in Table 2.

Study Area, Stands, and Cutting Tests

The study reported here was conducted on the Bent Creek Experimental Forest within the Pisgah National Forest near Asheville, North Carolina. The original stands of mixed oak and other hardwoods on the study area were rather heavy, ranging up to 24 M board feet in sheltered coves. Mixed with various species of oak were some yellow-poplars (*Liriodendron tulipifera* L.) 3 or 4 feet in diameter, and numerous chestnut trees (*Castanea dentata* [Marsh], Berkh.), some of them even larger. The chestnuts were nearly all infected and half of them dead from blight (*Endothia parasitica* [Murr.] A & A) by 1930 and 1936, in which period they were removed for tannic acid wood. Except for this salvage cutting the tract was virgin when the first silvicultural treatments were planned in 1936.[4] Site quality for yellow-poplar ranges from 73 to 77 feet in 50 years. For most of the oaks the site index is 10 to 15 feet less. Improvement and harvest were combined in one sale covering 50 acres, removing from 4 to 24 M board feet per acre. It was impossible to dispose of all undesirable trees in this operation and also retain enough timber to study growing stock levels. The reserved portion still contained some poorly formed, defective, mature, or over-mature trees. The stands were irregular because of the prior

[2]In the present experiment 180 board feet was the periodic annual (15-year average) per-acre growth in *gross* volume where the initial stocking was 4 M board feet of mixed oak forest. But, owing to defects, a stocking of 10 M was necessary to grow 180 board feet in net volume.

[3]This nearly matches the 25 cubic feet of periodic annual yield from pulp-sized trees only on the experimental area, where the starting volume was 3.4 M board feet or 30 percent stocking (Figs. 2 and 3). These stands contained 20 trees 6 to 10 inches d.b.h. or a total of 37 merchantable trees per acre. In an earlier test of cutting methods at Bent Creek (*14*) an uncut 8-acre check plot averaged 88 board feet and 23 cubic feet of growth per acre annually for 20 years. Meanwhile, after absolute clearcutting and mowing, another 6-acre tract in the series produced only 4 board feet and 56 cubic feet per acre annually. Now at 20 years that tract has a dearth of saw logs and is fully stocked with cordwood only.

[4]Tests started by L. I. Barrett, silviculturist.

TABLE 2.—AVERAGE VOLUME OF EACH SPECIES LEFT PER ACRE AFTER CUTTING IN 1937[1]

Species group	Saw logs		Pulpwood	
Desirable[2]	*Bd. ft.*	*Percent*	*Cu. ft.*	*Percent*
Chestnut oak	932	28	69	26
Northern red oak	850	26	37	14
Yellow-poplar	948	29	17	7
Black locust	31	1	9	3
Sweet birch	40	1	11	4
Basswood, ash, etc.	125	4	16	6
Total	2,926	89	159	60
Less desirable[3]				
Red maple	129	4	38	14
Hickory	144	4	33	12
Sourwood	6	0	19	7
Hemlock	76	2	7	3
Miscellaneous	32	1	11	4
Total	387	11	108	40

[1]Pulpwood volumes included all trees 3.6 inches d.b.h. and larger. At present the 4- and 6-inch trees may well be reserved from sale, as there is small profit in handling them.

[2]Chestnut oak, regarded as desirable in 1937, is now classified with the less desirable species group. Desirables as of 1937 were: *Quercus prinus* L., *Q. rubra* L., *Liriodendron tulipfera* L., *Gleditsia triacanthos* L., *Betula lenta* L., *Tilia* L., *Fraxinus* L.

[3]*Acer rubrum* L., *Carya* spp., *Oxydendrum arboreum* (L.) DC., *Tsuga canadensis* (L.) Carr.

TABLE 3.—REPRODUCTION PER ACRE OF MOUNTAIN HARDWOODS 7 YEARS AFTER VARIOUS DEGREES OF CUTTING[1]

Treatment	Basis: number of plots	Desirable species	Less desirable	All	Percent desirable
		SEEDLINGS (SINGLE STEMS)			
Clearcutting	10	506	184	690	73
Partial cutting	30	253	117	370	68
Uncut stand	10	240	160	400	60
		SPROUTS (MULTIPLE STEMS)			
Clearcutting	10	186	64	250	74
Partial cutting	30	74	52	126	59
Uncut stands	10	94	32	126	75
		REPRODUCTION (ALL STEMS)			
Clearcutting	10	692	248	940	74
Partial cutting	30	327	169	496	66
Uncut stands	10	334	192	526	63

[1]In 1- to 3-inch d.b.h. classes, inventoried in July 1944.

TABLE 4.—EFFECT OF CUTTING ON DISTRIBUTION OF SEEDLINGS AMONG SEED-WEIGHT CLASSES AFTER 7 YEARS

Treatment	Basis: number of plots	Seed weight class[1]			
		Light	Medium	Heavy	All
		Percent of seedling stand in 1944			
Clearcutting	10	64	16	20	100
Partial cutting	30	60	19	21	100
Uncut stand	10	52	26	22	100

[1]Ranges in average numbers of seeds per pound: heavy 75 to 1,185; medium 3,000 to 10,000; light 14,000 to 5,500,000.

removal of large chestnut trees, yet they were typical of much mountain forest in need of improvement cutting.

Ten 1-acre plots were devoted to each of five levels of residual stocking. The plan was to compare clearcutting of all merchantable timber with cuts leaving 1 to 6 thousand board feet per acre and uncut check acres with 7 to 10 thousand each. Since under-saw-log-size trees contributed materially to the growth response, a measure of stand density was the principal independent variable used in analyzing the results. Starting volumes in relation to six stand densities are shown in Table 1. Gross volumes varied from 210 cubic feet per acre for 10 percent stocking to ten times as much under 45 percent stocking. The heavier cuts removed nearly all the saw-log-sized trees of the less desirable species, but most of the reserved trees of all sizes and the dominant ones on the untreated plots also were of desirable species. The distribution of volume left among the various species is given in Table 2. Nearly 9 out of 10 saw-log trees in the residual stand were of desirable species, and 6 out of 10 pulpwood trees were in that group.

The first growing season following harvest was 1937. Effect on reproduction was studied 7 years later, and on growth and yield 15 years later (1952).

Results

Reproduction was sampled on four quadrats covering 5 percent of each test acre. The results in 1944 were averaged by major treatment and species groups as in Table 3. No analysis by separate species or levels of overstory stocking was attempted, owing to irregularities arising from many sources, including uncontrolled seed dispersal from the sides of the cut-over plots.

The partially cut and uncut areas were much alike in both quantity and quality of reproduction present. Nearly twice as many stems per acre resulted from the additional space made available by clearcutting. The percentage of desirable species likewise increased slightly with degree of cutting.

Light-seeded species, like sweet birch, yellow-poplar, and black locust on this area, possess a competitive advantage over the heavy-seeded species where extensive clearings need reseeding from adjacent uncut timber. Seeding from the side was prevalent on the experimental area, but the advantage over the heavy-seeded oak and hickory could not be clearly shown because the heavy cuttings were confined to 1-acre plots intermingled with the others. In this respect the experiment indicates what may be expected from groupwise types of cuttings rather than from extensive uniform harvest cutting systems. About a fifth of all seedlings were

of heavy-seeded species regardless of degree of cutting. Reproduction from light seeds showed a small but consistent increase with degree of cutting (Table 4).

The distribution of the 7-year-old seedlings, of course, has been influenced not only by differences in seed dispersal (i.e., how much light seeds may travel in the wind or how little the heavy seeds may roll on sloping ground) but also how well they could germinate and grow after coming to rest. Yellow-poplar produces seeds prolifically, but its germinative capacity is only about 5 percent. Its regeneration was better in clearings than under an overstory, but the seedlings require moisture and did not survive well on dry sites under any stand condition. In moist locations some 1,360 new yellow-poplar stems per acre were found on clearcut plots and only 160 per acre where the stand contained 5 M board feet or more. Sweet birch likewise reproduced best on heavily cut and moist sites. There were 1,200 per acre on moist clearcut plots, as against 400 under stands of 5 M board feet or more.

Oak seedlings were as numerous on the dryer sites and under trees as elsewhere at the start. Slower growth, however, resulted in a somewhat smaller number able to survive under trees than in the open.

Analysis of variance among all plots using stems per acre of all desirable species indicated that moisture was the only variable having a significant effect on reproduction. However, when the comparison of treatments was confined to the moist half of the tract, the clearcut plots were found to be reproduced significantly better than the others. This contrast would have been more pronounced had it not been for deer; they browsed heavily on yellow-poplar seedlings.

Where an adequate source of seed to supplement sprout regeneration is available to each of two comparable sites, cuttings that leave equal growing stocks may still fail to provide equal opportunities for seedlings. Despite equal high-level competition after cutting, new seedlings tend to be more abundant where the original forest was heaviest for two apparent reasons: (1) a seedbed improved through extensive scarification from logging, and (2) a relative scarcity of underbrush or herbaceous ground cover. The removal of a dense, original stand of relatively small trees likewise favors coppice growth because there are so many established root systems capable of vigorous sprouting.

The hardwood regeneration present before the cutting developed rapidly after the cutting into large sapling and small-pole sizes. On 75 percent of the area these trees overtopped the stems that originated after the cutting. By 1952, these pulp-sized trees that came from the advanced reproduction were monopolizing all space available for new growth. Reproduction since cutting—the 1- to 3-inch saplings—can find room to grow on only 25 percent of the area. The regeneration was completed successfully in 15 years. Contrary to expectations it came largely from advance reproduction.

Changes in Size-Class Distribution

Since ingrowth, mortality, and the enlargement of surviving trees are three essential elements, net increment is best measured by contrasting inventories made at the beginning and end of a growth period. In Figure 1, for each of three starting densities the natural rearrangement of size classes during 15 years is compared with the balanced distributions sought in all-aged management for continuous yield. Stands cut in 1937 to 20, 40, and 60 percent of maximum reached 60, 70, and 80 percent, respectively, by 1952 (see shaded areas in Figure 1). The cutting had left each one understocked in 1937. This condition was outgrown by 1952; yet in all size classes the number of trees was still under the indicated maximum over the full range of diameters. In all-aged management it is appropriate that each stand always be kept below this maximum which represents biological equilibrium. The optimum indicated in Figure 1 and Table 5 is appreciably lower and constitutes a more practical yardstick. This theoretical optimum for a managed stand, adapted from Eyre and Zillgitt's (*5*) recommendation for hardwoods in the Lake States, is 72 percent of the normal or fully stocked maximum from Schnur's (*12*) average stocking for fully stocked stands on site 75 and at age 85. The distribution of sizes follows de Liocourt's (*3*) law for a many-aged forest. From different starting points each of the three stands in Figure 1 had attained by 1952 the optimum number of twelve 11-inch trees per acre. Note, however, that while the actual numbers of saw-log-size trees approached the optimum, the smaller trees surpassed it (The X line in Fig. 1*A* and *B*).

As expected, the diagrams show that heavy cutting tends to destroy an all-aged balance in size distribution, and promote relatively even-aged distribution in the new growth. Whether this is good or bad depends on the form of silvicultural control desired. Even with a small number of age classes present, light cutting tends to furnish the diameter distributions typical of many-aged selection stands.

Composition Changes

The classification of species into two groups, desirable and less desirable as in Table 2, is based on commercial preference. All but two of these more valuable species

TABLE 5.—DATA FOR "BALANCED" STANDS USED AS "YARD STICKS"[1]

Measures of stocking		Optimum[2]	Maximum[2]
Diameter of tree of average basal area	Inches	10.0	10.9
Stand (trees per acre)	Stems	168	196
Density of stand	S.D.I.	168	232
Basal area per acre	Sq. ft.	92	128

[1]See dash and X line in Figure 1.
[2]Q value, the quotient between number of trees in successive 2-inch diameter classes, equals 1.4.

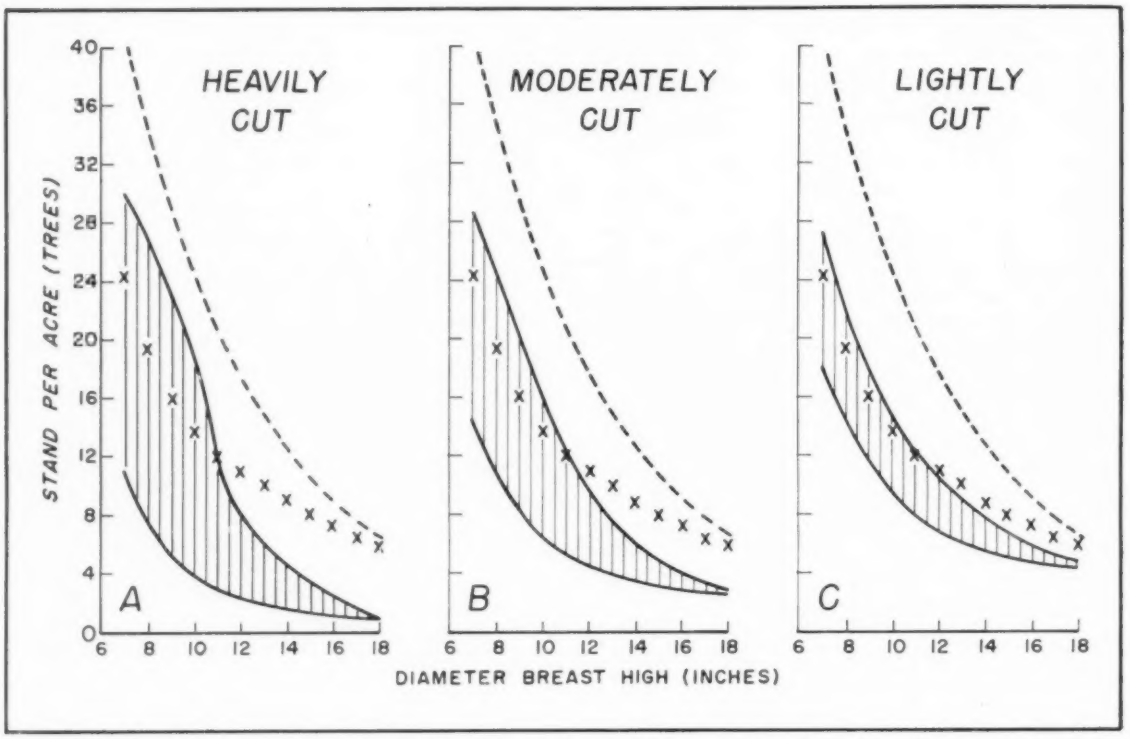

FIG. 1.—Shaded areas show 15-year average changes in actual diameter distribution after cutting compared with the biological maximum (dash line) and management optimum (*X* line) distribution. The *X* line, necessarily tentative and somewhat arbitrary, is designed to represent the balanced distribution suitable for long-term selection management for sustained yield.

showed a gratifying tendency to maintain or increase the relative position in which they were left after partial cutting. The only two desirables that lost some ground were the northern red and chestnut oaks. All but two of the less desirable species decreased the relative position in which they were left after cutting. The two less desirable species that gained some ground were red maple and hickory. Species that increased are segregated from those that decreased in Table 6. The more aggressive group gained 26 percent after heavy cutting, 11 percent after moderate cutting, and 9 percent after light cutting. Corresponding equal losses were shown by the other group. For all starting densities together the shift in composition in the 15 years subsequent to cutting involved 13.5 percent of the total residual basal area (last column, Table 6). The direction of the change was commercially desirable for all species except for the decrease in northern red and chestnut oaks and for the increase in hickory and red maple.

Diameter Growth of Trees

Average periodic annual growth, based on remeasurement of numbered representative trees is given in Table 7. It relates growth response for five of the principal species to stand density. The species are listed in ascending order of their rate of diameter growth in stands not over 50 percent stocked at the start of the period. The data in the column for 60 percent stocking suggest little difference in the growth of these species where they begin to crowd each other, except for northern red oak and yellow-poplar. Intolerant of shade, the yellow-poplar must overtop its associates if it is to maintain anywhere near its rapid initial rate. Within the range of densities tabulated, increased crowding resulted in a loss of 72 percent in the growth of yellow-poplar. By contrast, the northern red oak lost only 27 percent.

Annual Growth of Stands

Periodic annual growth in volume as observed in this experiment for stands 20 to 60 percent stocked[5] averaged about 60 cubic feet per acre regardless of stand density. Of this, 72 percent was in desirable species. These data include both small-tree and saw-log volumes, all in cubic feet. On this basis only is there freedom from any discernible trend with density.

In these tests the basal-area growth starting with a stock of 80 square feet per acre was only about a third as much as that with an initial stand of 40 square feet, or a fourth as much as with a start of 20 square feet. The increase in number of trees as well as total basal area growth varied inversely with the basal area or density of stocking at the start in 1937 (Figs. 2 and 3).

With the major products meas-

[5]Percentage of "maximum." See footnote 1, Table 1.

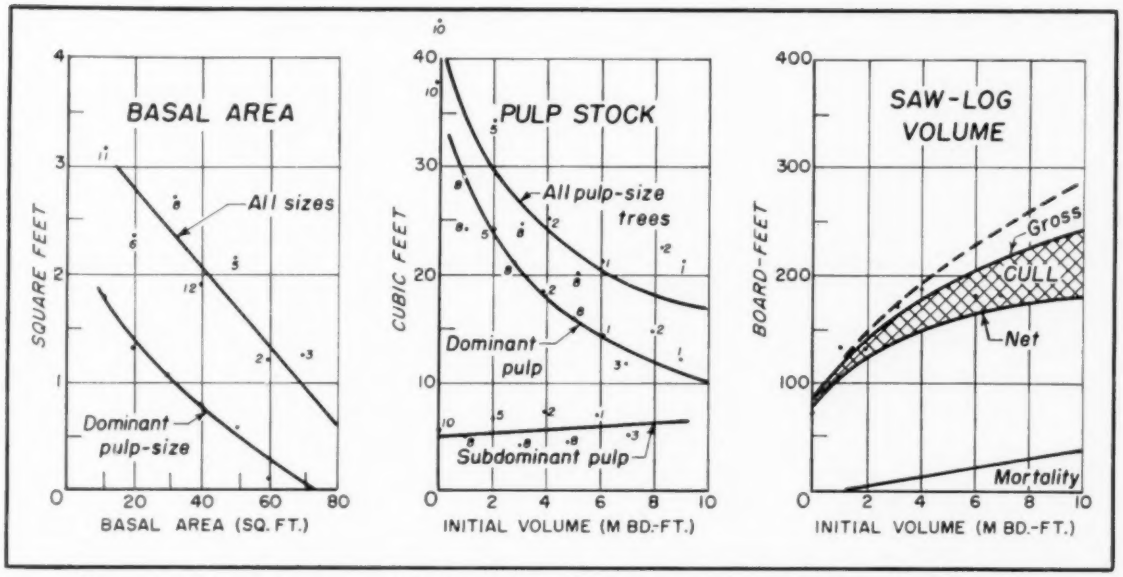

FIG. 2.—Annual growth per acre, 1937-1952, of the total stand and of the saw-log and pulpwood portions separately, in relation to starting basal area or volume per acre.

TABLE 6.—CHANGE IN SPECIES COMPOSITION DURING 15 YEARS (1937 TO 1952) AS INDICATED BY SHIFTS IN PERCENTAGE OF INITIAL BASAL AREA AT EACH OF THREE LEVELS OF STOCKING[1]

Species	Initial basal area per acre by starting density				Composition change by starting density			
	Low (10 plots)	Medium (36 plots)	High (4 plots)	All (50 plots)	Low (10 plots)	Medium (36 plots)	High (4 plots)	All (50 plots)
	GROUP THAT INCREASED							
	Square feet				*Percent*[2]			
Yellow-poplar	1.02	4.98	15.44	5.03	+17.8	+ 2.2	+4.7	+ 4.4
Red maple	.97	3.11	7.11	3.02	+ 1.9	+ 5.3	+ .6	+ 4.3
Black locust	.39	.79	.91	.72	+ 4.7	+ 1.0	+ .1	+ 1.9
Basswood & ash	.20	1.13	2.47	1.05	+ 2.6	+ 1.5	+2.1	+ 1.7
Sweet birch	.33	1.13	1.86	1.03	+ .5	+ .5	+ .9	+ .7
Hickory	1.17	3.03	7.56	3.04	− 1.4	+ .5	+ .9	+ .5
Group total	4.08	14.17	35.35	13.89	+26.1	+11.0	+9.3	+13.5
	GROUP THAT DECREASED							
Chestnut oak	2.21	12.20	19.71	10.80	− 8.2	− 9.8	−6.7	− 9.8
N. red oak	2.72	8.52	13.28	7.75	−10.4	− 1.6	+2.3	− 1.9
Hemlock	.10	.80	7.82	1.22	0.0	− .2	−3.5	− 1.2
Sourwood	1.01	1.31	1.70	1.29	− 6.9	− .1	+ .3	− .5
Miscellaneous	.49	1.13	4.27	1.25	− .6	+ .7	−1.7	− .1
Group total	6.53	23.96	46.78	22.31	−26.1	−11.0	−9.3	−13.5

[1]Where 100 percent equals S.D.I. 232, and starting densities were: *low* less than 15 percent, *medium* 15 to 50 percent, and *high* over 50 percent.
[2]Where 100 percent equals basal area of both groups at the start, i.e., after cutting in 1937.

ured separately in these tests—pulpwood in cubic feet and saw logs in board feet—growth analysis immediately revealed divergent trends in relation to starting volume or stand density. Both were curvilinear, the pulp trend downward and the saw-log trend upward within the range of densities studied. A tendency for these opposite trends to cancel out explains the earlier observation that the average growth of 60 cubic feet (saw

TABLE 7.—AVERAGE ANNUAL DIAMETER GROWTH DURING 15 YEARS AFTER PARTIAL CUTTING[1]

Species	Stems measured	Initial stocking (percent)					Decrease with density increase
		20	30	40	50	60	
	Trees	*Inches*					*Percent*
Sweet birch	26	.18	.17	.15	.14	.13	28
Chestnut oak	199	.22	.20	.18	.15	.13	41
Red maple	84	.25	.22	.19	.15	.12	52
Yellow-poplar	72	.32	.26	.21	.15	.09	72
Northern red oak	128	.33	.31	.29	.27	.24	27

[1]Growth of wood and bark on sample saw-log trees 9.6 inches in d.b.h. and larger.

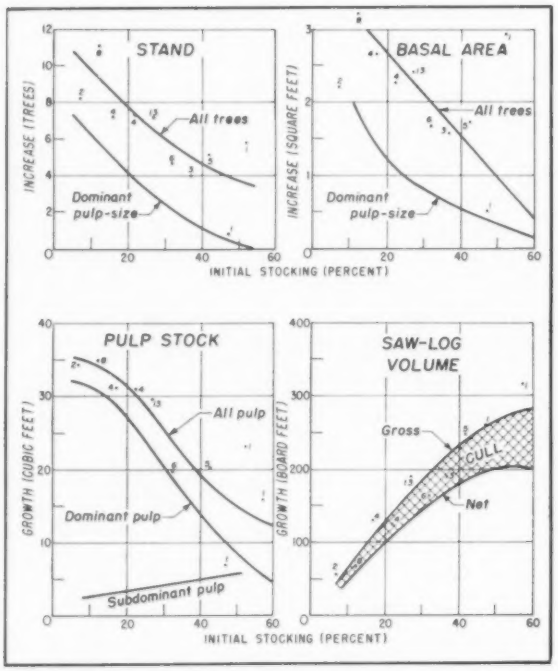

FIG. 3.—Total annual increases, 1937-1952, in trees and basal area per acre and volume growth of pulp and saw logs separately, in relation to percentage of initial stocking.

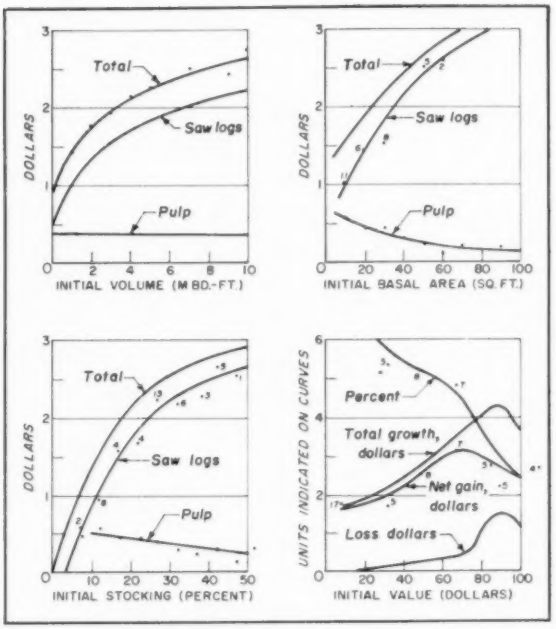

FIG. 4.—Average annual value increment per acre, 1937-1952, in relation to various measures of the starting condition.

logs included) was independent of density at the start.

Where stands started here with 2 M board feet of timber per acre, less than 150 board feet grew annually, and there was also room for 30 cubic feet of pulpwood growth. Where the stand started with 6 M board feet of timber, over 200 board feet grew annually, and there was space for only 20 cubic feet of the less valuable pulpwood growth. The standard error of the curve marked *gross* in Figure 2 is 64 board feet. Produced together with saw logs, pulp-size trees always occupy part of the more valuable timber-growing space, but they are essential as recruits and beneficial as trainers.

Similar trends in growth per acre per year are manifest when forest density, as in this study, is expressed as a percentage of full stocking (Fig. 3). Starting with a density of only 20 percent, the annual growth was 125 board feet gross and 96 net. Gross growth in board feet averaged 280 and net growth 200 board feet annually, where stocking had been 60 percent 15 years before. A maximum net growth of 205 board feet followed the starting density of 55 percent. The trend was downward from this point owing to the heavy losses from mortality of poor-risk veteran trees left in the heavier stands.

Mortality

Mortality in premerchantable young growth, a part of the natural thinning process, is beneficial. Mortality among saw-log trees is a loss that can usually be largely avoided in managed forest. The first cut in this experiment, starting with so many overmature trees, was too late to preclude all mortality. Some poor-risk trees had to be left to make up the desired levels of stocking to be tested.

The volume and value of the saw logs lost after cutting has been computed in relation to initial stocking (Table 8). The relatively heavy loss on areas of high initial density is ascribed to the presence of poor-risk trees rather than to any effects of crowding. At 10-percent stocking, the 10-year mortality of 1 percent was a loss of one dollar per acre. Mortality increased with density to nearly 5 percent of the volume, and loss to $13.60 per acre 40-percent stocked. Above 40 percent in initial stocking, mortality was irregular, showing no continuation of the trend shown in Table 8, but stocking over 50 percent resulted in the heaviest mortality. In these heavier stands the 10-year loss per acre (in net Scribner volume) was 270 board feet. By contrast, the group of stands starting less than 40-percent stocked (averaging 24 percent) lost less than 40 board feet, or only about one-seventh as much.[6]

Value Growth from Initial Stock[7]

The average annual rates of in-

[6] Relatively heavy losses from areas above starting densities of 40 or 50 percent account for the crest in the curve for net saw-log value growth (Fig. 4) to be discussed in the following section. Such losses can be almost wholly eliminated in well managed second growth.

[7] In this study the influence of inflationary or other price changes with elapsed time are excluded by using a single set of stumpage prices, those of 1952, in all appraisals.

crease in stumpage values ranged from 1 to 3 dollars per acre. They were clearly related to both the volume and the value of stock on the ground at the beginning of the growth period. The relationship was manifested in these tests when starting conditions were shown in any one of four different ways. Thus the initial levels of stocking were expressed, not only as a percentage but also in absolute numbers of square feet, board feet, or stumpage value in dollars. These four units were independent variables used in analyzing the trend of value increase shown in Tables 9 and 10, and Figure 4. The trends in the first 3 graphs of Figure 4 are analogous, confirming the increase of growth with initial volume of stocking first noted for growth in board feet only (Fig. 3).

The value of pulpwood growth was fairly constant in relation to the various starting volumes measured in board feet only, but dropped for the heavier stands when the starting condition was measured in basal area or in density of the stand as a whole. Pulpwood value growth rates account for less than a third of total value increment; the rest was accretion in saw log values. The value of total growth increased steadily in respect to greater starting basal area, growing stock volume or stand density. The increase became more gradual above 30 percent stocking, but did not decline within the limits shown in Figure 4.

Where starting stumpage values exceeded $90 per acre, however, the value of total growth did decline. The reduction is traceable to a sharp increase in mortality of large, high-grade but poor-risk trees. The curve of net value growth consequently reached a peak for plots with not over $70 worth of stock per acre at the start (lower right graph in Fig. 4).

In forests where all undesirable trees have been removed, the value growth may peak at a different point. This experiment does not reveal at what forest density either the volume or the value increment of managed second-growth timber will culminate. The results apply only to the transition stage where an attempt is being made to rehabilitate neglected old-growth stands with a single improvement cutting.

TABLE 8.—VOLUME AND VALUE PER ACRE OF TREES LOST IN RELATION TO STOCKING

Initial stocking (1937)		Ten-year mortality rate[1]				
		Gross	Net	Gross	Net	Value
Percent	*Board feet*	*—Board feet—*		*— Percent —*		*Dollars*
10	—	2	2	1.0	.8	1.00
15	300	10	10	1.4	1.2	1.20
20	1,400	26	22	1.9	1.6	1.50
25	2,500	57	52	2.3	2.1	2.00
30	3,600	103	93	2.9	2.5	3.10
35	4,700	164	148	3.6	3.2	5.10
40	5,800	283	247	4.9	4.3	13.60

[1]Based on records for 15 years, 1937-1952. The Scribner log rule was used for gross and net volumes. The difference is the estimate of cull volume. All trees 9.6 inches d.b.h. and larger are included. At densities higher than those shown here, the volume of mortality was extreme on some of the plots, owing solely to the burden of large poor risk trees—a condition wholly unrelated to the density range in well managed stands.

TABLE 9.—EFFECT OF STARTING BASAL AREA AND VOLUME ON ANNUAL INCREASES IN VALUE PER ACRE[1]

Starting basal area	Value growth			Starting volume	Value growth		
(Sq. ft.)	Pulp	Saw logs	Total	(M. bd. ft.)	Pulp	Saw logs	Total
	Dollars				*Dollars*		
10	.56	1.00	1.56	1	.38	1.07	1.45
20	.45	1.42	1.87	2	.38	1.37	1.75
30	.37	1.85	2.22	3	.38	1.57	1.95
40	.30	2.17	2.47	4	.38	1.74	2.12
50	.25	2.45	2.70	5	.38	1.87	2.25
60	.22	2.63	2.85	6	.38	1.97	2.35
70	.20	2.80	3.00	7	.38	2.06	2.44
80	.17	2.94	3.11	8	.38	2.14	2.52
				9	.38	2.19	2.57
				10	.38	2.25	2.63

[1]Approximate values from the curves of Figure 4.

TABLE 10.—EFFECT OF INITIAL STOCKING AND VALUES ON ANNUAL INCREASES IN VALUE PER ACRE[1]

Starting density	Value growth			Starting value	Value growth		
(Percent)	Pulp	Saw logs	Total	(Dollars)	Total	Loss	Net
	Dollars				*Dollars*		
10	.53	.85	1.38	10	1.70	.05	1.65
15	.50	1.33	1.83	20	1.90	.15	1.75
20	.42	1.71	2.13	30	2.15	.22	1.93
25	.35	2.02	2.37	40	2.45	.25	2.20
30	.40	2.16	2.56	50	2.87	.27	2.60
35	.37	2.33	2.70	60	3.30	.30	3.00
40	.33	2.47	2.80	70	3.63	.48	3.15
45	.30	2.56	2.86	80	4.10	1.10	3.00
50	.26	2.66	2.92	90	4.25	1.55	2.70

[1]Approximate values from the curves of Figure 4.

Summary

Appalachian hardwood old-growth with dead chestnuts removed was cut in 1937 to levels of stocking varying from 0 to 10 M board feet per acre. Results were gaged by reinventory of reproduction 7 years later and growing stocks 15 years later.

Regeneration of light-seeded species increased with the intensity of cutting in the overstory. Yellow-poplar seeds are well disseminated by wind, but the germination is low and the seedlings prefer a moist site. This species did not reproduce well on dry sites under any stand condition. Sweet birch likewise reproduced best on heavily cut and moist sites. These and the other desirable species, as a group, had a natural tendency to maintain or increase their relative position in the stand, at least on the better

sites.

The initial advantage that light-seeded species have in the regeneration of the larger openings made in cutting timber was reduced somewhat as the smaller stumps of cut trees and broken saplings sprouted. The new stand was of mixed seed and sprout origin. Both seedlings and sprouts were more numerous and developed faster in the larger openings. The distribution and density of reproduction was best on the more heavily cutover areas, but all the cutover areas were well regenerated in 15 years.

Diameter growth increased with decreasing stocking of residual stand down to 20 percent of maximum stocking. Among the less desirable species, 2 inches in 10 years was the typical rate. Many of the yellow-poplars and the northern red oaks grew 3 inches in 10 years. Yellow-poplar, intolerant of shade, must overtop its associates if it is to keep anywhere near its rapid initial rate, but the red oak readily maintains a satisfactory rate well into the larger size classes even if moderately crowded.

A maximum net growth of 205 board feet per acre annually was attained with a starting volume of 7,200 board feet or a density 55 percent of the maximum. A considerable number of scarlet oak and other less desirable species were included. For heavier stands the net growth was less, only because of mortality among poor-risk veteran trees left deliberately to observe high-level stocking.

Saw timber growth accounted for over two-thirds of the average annual value increment. Less than a third of the usual 1- to 3-dollar increase per acre came from pulpwood. The net value of total growth per acre increased with starting volumes and their corresponding values up to a point where $70 worth of stock was left after cutting. At this point the net growth was about $3. Within the range of conditions observed in this study, the trends of increase in value increment, like those in net volume growth, reached a crest only because some financially overmature timber had been retained.

Similar tests in improved second-growth stands are needed to determine the optimum timber growing density to realize maximum values.

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Found

Will the Society member who inquired at the annual meeting registration desk at Portland, Oregon, about a lost article at Oaks Park (barbecue night) please communicate with Miss Audrey Warren, Society of American Foresters, Washington 6, D. C.

The Spacing Interval for Supplemental Shelterbelts[1]

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SHELTERBELTS, walls, snow fences, strips of crops, and other obstacles placed in the path of wind are known generally as surface barriers. The basic definition usually given for this term states that a surface barrier is any obstacle placed in the path of the wind in such a manner that it causes an upward diversion of the air current. This diversion is accompanied by a drag on the wind at approximately the same height as the obstacle. These combined effects lessen the drag on the original ground surface, lower the prevailing surface velocity, and create a pool of relatively calm air within the zone of influence of the obstacle. This zone of influence is limited, of course, and usually does not extend to distances greater than 20 or 30 times the height of a given barrier. Since the requirements for protection usually far exceed this limited influence, it becomes necessary to extend the influence. In the case of shelterbelts this can be accomplished by creating a continuity of properly oriented supporting or supplemental belts. This study is concerned primarily with obtaining information relative to the spacing of the so-called properly oriented continuity of belts.

There are several aspects to the problem of determining the best spacing interval for a system of shelterbelts. The principal reason for planting any shelterbelt is to reduce wind velocities. The amount and type of reduction needed, however, depend upon the object or objects to be protected and the purpose of the protection, i.e., is the reduction in wind desired for the comfort of people or livestock, reduction in home heating loads, control of drifting snow, or for minimizing soil movement by wind.

Limiting the investigations to only one of these purposes, however, does not completely solve the dilemma. For example, determination of the best spacing to control erosion of soil must be concerned also with the susceptibility to erosion of the soil that is to be protected. This varies considerably and it is difficult to prescribe a general formula for velocity reduction required to stop erosion because of factors affecting the vulnerability of the soils. Dryness, texture, roughness, and many other factors are involved. The economic aspect is another factor that must be considered, i.e., what proportion of the cropland can be economically devoted to trees to afford protection for the remaining land. Bates (*1*) has indicated that in the corn belt, 5 percent of the area could be devoted to belts because of the direct benefits to crops and animals. The percentage of area, of course, varies with different crops, climatic conditions, and the intensity of agriculture practiced in a particular region. For example Chepil (*2*) has reported that in the sandy lands of China, single rows of willow belts averaging 12 feet in height are planted every 50 or 60 feet. Here, where an intensive type of agriculture is practiced this close spacing is necessary and economical. It might not apply, however, on large areas such as western Kansas where climatic conditions and economic ratios would not be favorable.

This particular study does not and could not deal with all the above mentioned aspects of the problem. The object of the study is to obtain qualitative information on the mechanical reduction of wind velocity. Previous studies (*3, 4, 5*) have shown that one of the best ways to obtain data on relative results is with a wind tunnel wherein many of the variables can be controlled for sufficient time to make detailed studies. The reliability of results obtained with the tunnel has been tested in previous study (*6*) which showed rather good agreement between model and prototype, provided the models are placed in a tunnel having a turbulent boundary layer of sufficient depth to be similar to atmospheric conditions.

Methods of Study and Procedures

The following variations and combinations of principal and supplemental shelterbelts were tested:

7-row principal belt with 3-row supplementals
7-row principal belt with 2-row supplementals
7-row principal belt with 1-row supplementals
3-row principal belt with 1-row supplementals
1-row principal belt with 1-row supplementals

The model shelterbelts used in the experiments were fabricated from cedar boughs and green lichen placed in short lengths of aluminum tubing. One 7-row principal belt, three 3-row supplementals, two 2-row supplementals, and three 1-row supplementals were constructed by orienting the "trees" and "shrubs" in a series of holes drilled in plywood bases. The scale used for the models was 1 inch equals 5 feet. Thus, in terms of the prototype condition, the lowest or windward shrub in a 7-row belt would be 7.5 feet and the tallest tree placed as the fifth row windward would be 30 feet. The second, third, fourth, and sixth tree rows would be 15, 20, 25, and 17.5 feet, respectively in prototype conditions. The seventh row was a shrub row corresponding to 10 feet high. The green lichen was used for the shrubs. The 3-row supplementals consisted of one shrub row

[1]Contribution 524, Department of Agronomy, Kansas Agricultural Experiment Station, Manhattan, and the U. S. Dept. Agri., Agricultural Research Service, Soil and Water Conservation Research Branch. Cooperative research in the mechanics of wind erosion.

[2]Western Section of Soil and Water Management, Agricultural Research Service, U. S. Dept. Agric. Kansas State College, Manhattan.

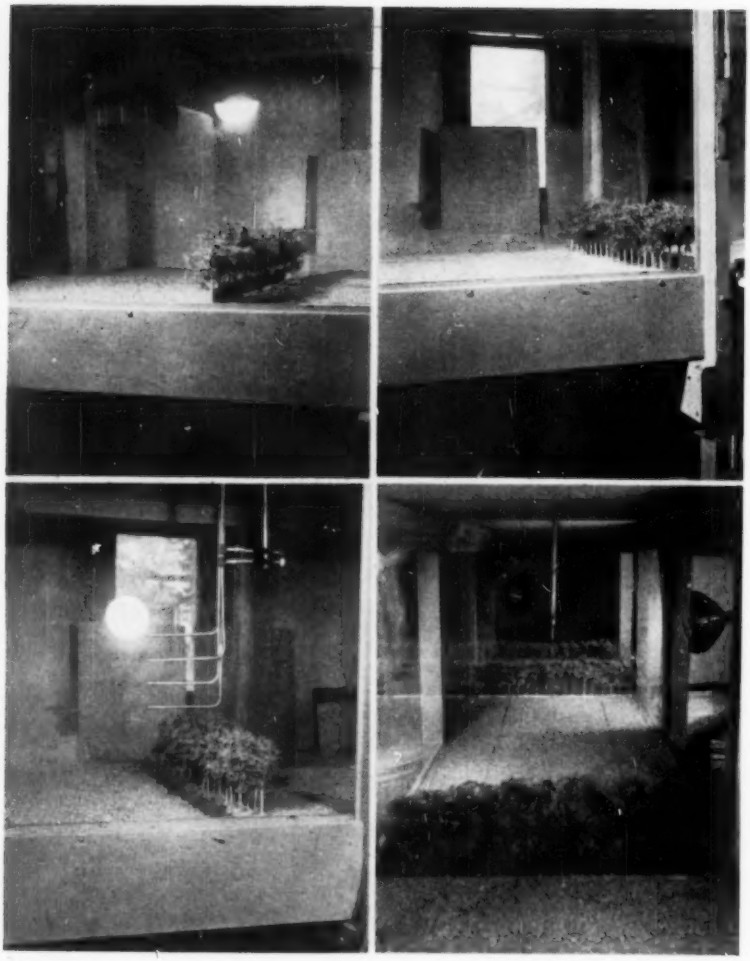

FIG. 1.—One-row, 2-row, and 3-row supplemental belts, and 7-row principal belt followed by two 1-row supplemental belts as they were oriented in tunnel (upper left, upper right, lower left, and lower right, respectively).

and two rows of tall trees. The 2-row supplementals consisted of two rows of tall trees with a row of shrubs placed in the leeward row of trees. The single-row supplementals consisted of a combination of one row of tall trees and shrubs. Spacing between the rows of shrubs and trees was 2 inches on the model, corresponding to 10 feet for field conditions. Spacing within the rows of trees was also 2 inches or 10 feet. Spacing between shrubs in shrub rows was 1 inch or 5 feet. Where combinations of shrubs and trees were used in one row, the spacing for the trees was 2 inches with two shrubs between each tree giving a spacing of approximately 0.67 inch or 3.5 feet in prototype condition. Figure 1 shows views of the various models as they were oriented in the wind tunnel.

The studies of the effect of different spacing intervals on velocity reductions for the various belts were carried out in a laboratory wind tunnel described previously (7). The working section for these particular experiments consisted of a 16-foot horizontal length beginning 40 feet downwind from the blower. The top of the tunnel for this section was constructed to facilitate horizontal movement of a staff of Pitot tubes through the entire 16-foot length. The floor consisted of sieved gravel 2.0-6.4 mm. thus assuring development of a turbulent boundary layer similar to atmospheric conditions.

Horizontal velocity measurements were made at 12 different heights at various locations to the leeward of the belts with a group of 4 Pitot tubes and an alcohol manometer. The Pitot tubes were mounted on a rack and gear carriage to facilitate horizontal movement and on a staff gage equipped with a vernier scale for accurate vertical movement. All combinations and spacing intervals were tested at constant wind speeds of 16.8 and 27.8 mph. measured in the center of the tunnel at a location 12 feet upwind from the windward end of the test section. Testing procedures consisted of running complete traverses of clear tunnel velocities through the entire 16-foot length of test section in duplicate at each of the two velocities. Velocities to the leeward of the belts were then obtained at given location and divided by the velocity obtained at the same location in the clear tunnel. These ratios were used to plot profile maps expressing the height above the ground as the dimensionless ratio $\frac{z}{H}$ and the velocity ratio as $\frac{U_b}{U_o}$, where

z = elevation above surface at which velocity is measured.
H = height of tallest tree in belt (6 inches in the model or 30 feet in actual belt).
U_b = velocity aft of belt.
U_o = velocity in open or clear tunnel.

Percentage reductions in velocity are equal to $100\ (1 - \frac{U_b}{U_o})$. Vertical and horizontal distance on the profile maps is shown in terms of belt heights H.

Results

As a prerequisite to evaluating and comparing the effectiveness of the different combinations of shelterbelts it was necessary to establish arbitrary levels of velocity reduction. Levels of 50 and 75 per-

cent were chosen. While these are only arbitrary levels, one or the other should be appropriate for most wind velocity reduction problems.

In running the tunnel tests each combination of belts was first tested with the supplemental belt placed at spacing intervals of approximately 12, 18, and 24 *H*. Profile maps were drawn from the data obtained in these tests. Areas between the principal and the first supplemental belt and under the 50 and 75 percent reduction contours were determined with a planimeter. These areas were used as indexes of effectiveness and plotted versus the spacing interval. An approximate curve was then drawn and an equation determined for all cases where a definable trend in the data was indicated. In this respect it was found that the 3 points were sufficient to draw the curve and determine the equation in all cases except the 75 percent reduction level for the 7-row principal plus 2-row supplemental and the 50 percent reduction level for the 1-row principal plus 1-row supplemental. Here it was necessary to resort to trial and error methods for establishing the locations. After determining the approximate equations, the critical maximum points on the curves were located by methods of calculus wherein the first derivatives of the functions were set equal to zero and the resulting equations were solved for real roots. These points in combination with the information shown on the contour maps were used to determine the approximate spacing interval to maintain either a 50 or 75 percent reduction between belts. The final location was checked by velocity probings with the Pitot tubes. The spacing interval for the second supplemental was located also by velocity probings with the Pitot tubes. Complete traverses were run for levels of 50 and 75 percent reduction and were considered to be the "best" spacing for a particular system of belts. Areas under these curves also were obtained and used to establish the final spacing-effectiveness curve shown in the upper right corner of the figures which follow.

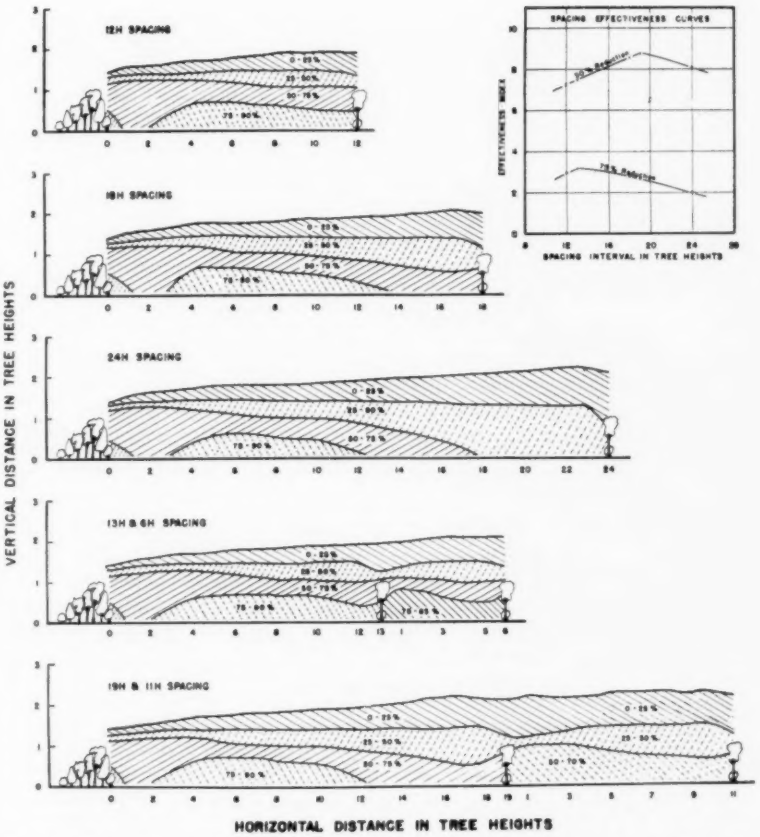

FIG. 2.—Percentage reduction in velocity obtained in vicinity of a 7-row principal belt with a 1-row supplemental belt placed at 12-, 18-, and 24-H spacing intervals. Lower two figures show "best" spacing interval for 75 and 50 percent reductions in velocity. Spacing-effectiveness curves are shown in upper right corner.

7-row principal belt with 1-row supplemental.—Figure 2 shows the data obtained on the 7-row principal and 1-row supplemental combination of belts. It is noted that at least a 50 percent reduction in velocity is maintained from tree top to ground level for the 12 *H* spacing. The level of this reduction begins to drop, however, for the 18 *H* spacing and finally strikes the ground at approximately 18 *H* with 24 *H* spacing.

The approximate equation, derivative, and critical maximum for the spacing-effectiveness curves based on the 12, 18, and 24 *H* spacing was:

50 percent reduction curve

$I = 4.78 + 0.21\ S - 0.0002\ e^{0.39\ S}$

$y' = 0.21 - 0.000078\ e^{0.39\ S}$

critical maximum = 20.1

75 percent reduction curve

$I = 5.14 - 0.13\ S - 208\ e^{-0.53\ S}$

$y' = 111\ e^{-0.53\ S} - 0.13$

critical maximum = 12.8

where S = spacing interval in tree heights H and I = effectiveness index, and y' = the first derivative of the equation for I.

The final spacing-effectiveness curves (upper right of figure) show a maximum spacing interval of 19 *H* for a 50 percent reduction in velocity and 13 *H* for 75 percent reduction. Maximum indexes at these spacings are 8.8 and 3.2 for 50 and 75 percent reduction, respectively. Increased spacing from these values show a decrease in effectiveness. The spacing required to maintain a 50 percent reduction between the principal and first supplemental belt is approximately 1.46 times greater than that required for a 75 percent reduction.

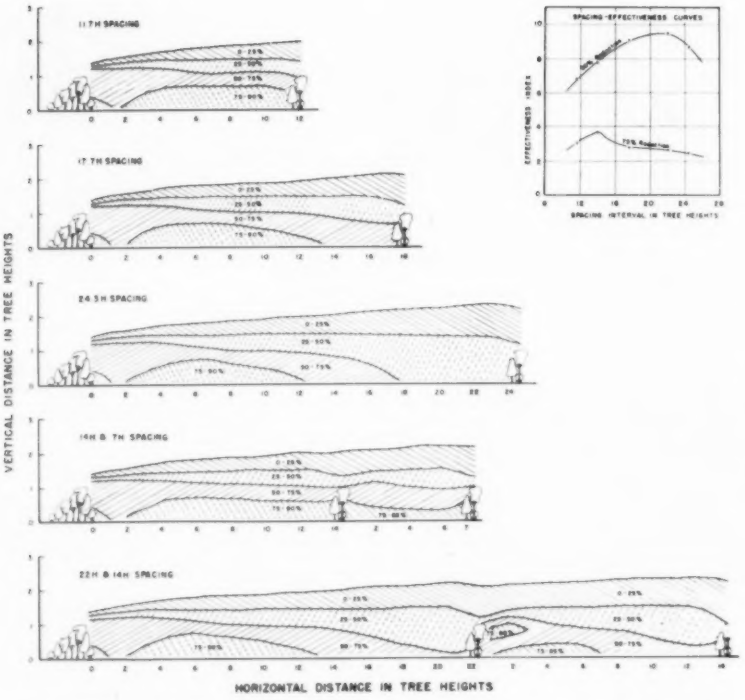

FIG. 3.—Percentage reduction in velocity obtained in vicinity of a 7-row principal belt with a 2-row supplemental belt placed at 11.7-, 17.7-, and 24.3 spacing intervals. Lower two figures show "best" spacing interval for 75 and 50 percent reductions in velocity. Spacing-effectiveness curves are shown in upper right corner.

The spacing between the principal and first supplemental belt is 1.74 times greater than the spacing between the first and second supplemental for a 50 percent reduction, and 2.2 times greater for a 75 percent reduction.

It also should be noted that this combination of belts maintains at least a 25 percent reduction in velocity for the longest, or 24 *H*, spacing tested.

7-row principal belt with 2-row supplemental.—Figure 3 shows data obtained on the 7-row principal and 2-row supplemental combinations of belts. The general shape of the reduction contours is nearly the same as the 7-row plus 1-row combination described above.

The approximate equation, derivative, and critical maximum for the spacing-effectiveness curves based on 11.7, 17.7, and 24.3 *H* spacing was:

50 percent reduction curve

$$I = 1.95 + 0.41\,S - 0.0012\,e^{0.32\,S}$$

$$y' = 0.41 - 0.0004\,e^{0.32\,S}$$

critical maximum = 21.7

75 percent reduction curve

Not determined

The final curve (upper right corner) shows the best spacing for a 50 percent reduction to be at 22 *H* with an index of 9.5, which is higher than the 7- plus 1-row combination. Best 75 percent reduction occurs with a spacing of 14 *H* and an index of 3.7. The spacing required to maintain a 50 percent reduction between the first two belts is approximately 1.57 times greater than that required for a 75 percent reduction. The spacing between the principal and first supplemental belt is approximately 1.6 times greater than the spacing between the first and second supplementals for a 50 percent reduction and 2.0 times greater for a 75 percent reduction.

This combination of belts also shows at least a 25 percent reduc-

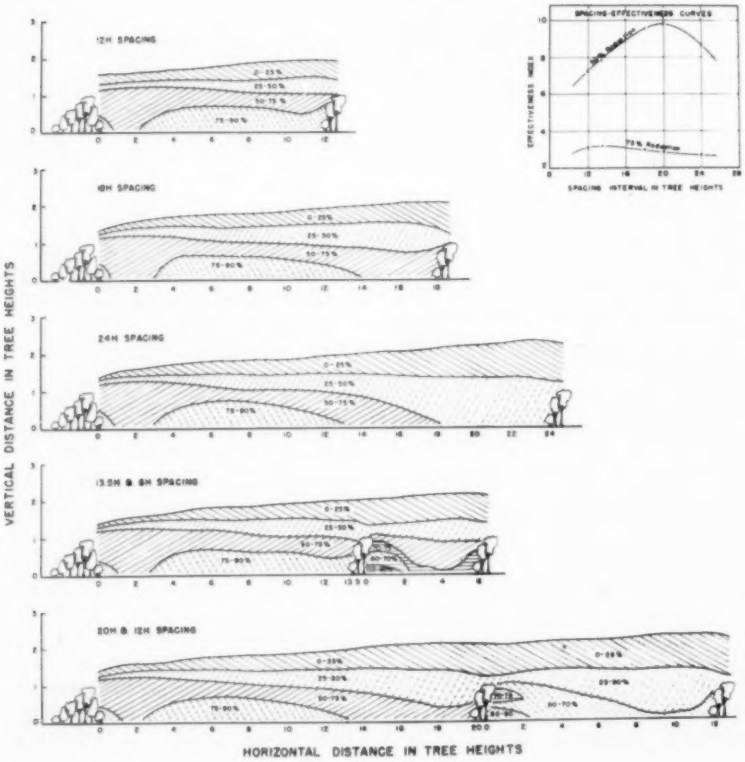

FIG. 4.—Percentage reduction in velocity obtained in vicinity of a 7-row principal belt with a 3-row supplemental belt placed at 12-, 18-, and 24-H spacing intervals. Lower two figures show "best" spacing interval for 75 and 50 percent reductions in velocity. Spacing-effectiveness curves are shown in upper right corner.

tion in velocity for the longest, or 24.3 H, spacing tested.

7-row principal belt with 3-row supplemental. — Figure 4 shows data obtained on the 7-row principal and 3-row supplemental combinations of belts. The general shape of velocity contours and of the spacing effectiveness curves is very nearly the same as the 7- plus 1-row combination.

The approximate equation, derivative, and critical maximum for the spacing-effectiveness curves based on 12, 18, and 24 H spacing was:

50 percent reduction curve

$$I = 2.80 + 0.38\ S - 0.0000128 e^{0.53\ S}$$

$$y' = 0.38 - 0.0000068\ e^{0.53\ S}$$

critical maximum = 20.6

75 percent reduction curve

$$I = 4.03 - 0.056\ S - 220\ e^{-0.59\ S}$$

$$y' = 130\ e^{-0.59\ S} - 0.056$$

critical maximum = 13.1

The final curve (upper right corner) indicates the best spacing for a 50 percent reduction in velocity is 20 H with an index of 9.8, slightly higher than 7- plus 2- and 7- plus 1-row combinations. Best spacing for 75 percent reduction is 13.5 H with an index of 3.2. The spacing required to maintain a 50 percent reduction between the principal and first supplemental belts is approximately 1.48 times greater than that required for a 75 percent reduction. The spacing between the principal and first supplemental belt is approximately 1.7 times greater than the spacing between the first and second supplementals for a 50 percent reduction and 2.2 times greater for a 75 percent reduction.

It will be noted in connection with this combination that it was not possible to maintain a 75 percent reduction throughout the entire distance between the first and second supplemental belt. Apparently, the location and porosity of the 3-row supplemental was such that leakage of air through the first supplemental permitted only 50 to 70 percent reduction immediately aft of the belt.

3-row principal with 1-row supplemental.—Figure 5 shows data obtained on the 3-row principal and 1-row supplemental combination of belts. The 3-row principal belt was not so effective as the 7-row belt. This belt did not provide a uniform 50 percent reduction between itself and the first supplemental belt. It was also impossible to obtain a continuous 75 percent reduction in velocity with this combination. A 40 percent velocity reduction was used, therefore, as the criterion of spacing.

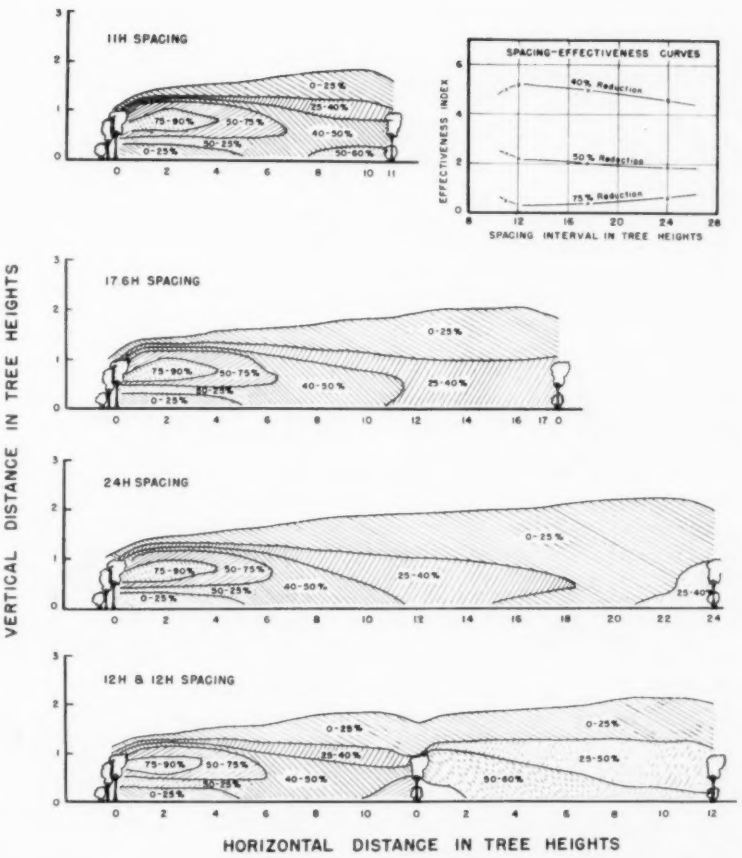

FIG. 5.—Percentage reduction in velocity obtained in vicinity of a 3-row principal belt with a 1-row supplecental belt placed at 11-, 17.6-, and 24-H spacing intervals. Lower figure shows "best" spacing for a 40 percent reduction in velocity. Spacing effectiveness curves are shown in upper right corner.

The approximate equation, derivative, and critical maximum for the spacing-effectiveness curve based on 11, 17.6, and 24 H spacing was:

40 percent reduction curve

$$I = 5.8 - 0.05\ S - 278\ e^{-0.625\ S}$$

$$y' = 174\ e^{-0.625\ S} - 0.05$$

critical maximum = 13.0

The final spacing effectiveness curves (upper right corner) indicate that the best spacing to maintain a 40 percent reduction is about 12 H. The effectiveness index associated with this spacing is 5.2. Both this index and the spacing interval are considerably below the values obtained with the 7-row principal belt.

While this 3-row principal did not produce a continuous 50 percent reduction between the first two belts, it did reduce the wind sufficiently to maintain a 50 percent reduction between the first and second supplemental at a 12 H spacing.

Single-row principal with 1-row supplemental. — Figure 6 shows

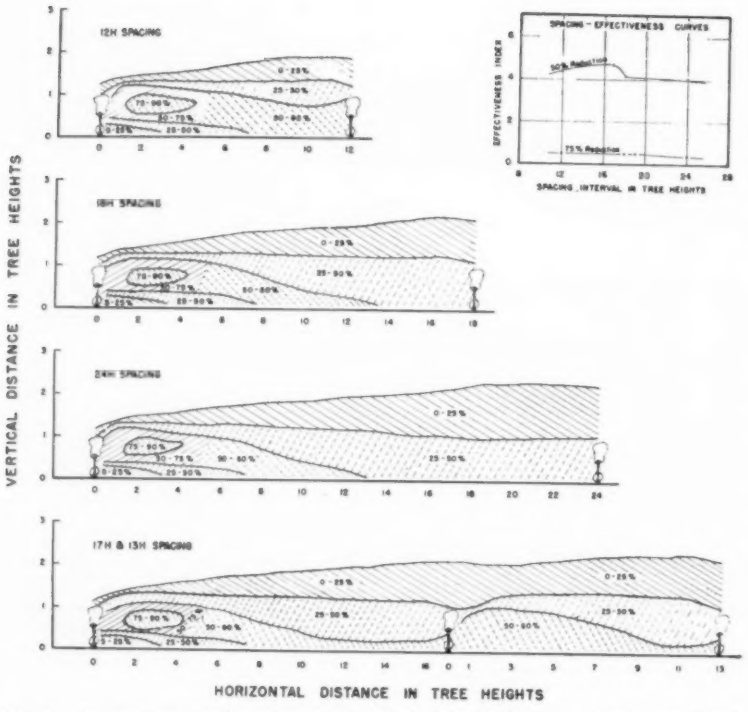

FIG. 6.—Percentage reduction in velocity obtained in vicinity of a single-row principal belt with a 1-row supplemental belt placed at 12-, 18-, and 24-H spacing intervals. Lower figure shows "best" spacing interval for a 50 percent reduction in velocity. Spacing-effectiveness curves are shown in upper right corner.

data obtained on the "narrow" single-row plantings. Velocity patterns immediately to the leeward of the principal belt are similar to those obtained with the 3-row principal. The jetting of air through the narrow, porous belts caused rather low velocity reductions immediately to the leeward. This combination of belts was, however, more effective than the 3-row principal because it was possible to maintain a continuous 50 percent reduction between the belts.

The spacing-effectiveness curves, as determined by trial and error methods, show the best spacing to be about 17 *H* with an index value of 4.6. A 75 percent reduction curve is also shown, but zones having this much reduction in velocity were relatively small pools immediately aft of the first belt and did not reach the ground level at any location between the belts. The best spacing between the first and second supplemental is 13 *H*, or about 25 percent less than the spacing between the principal and first supplemental.

Discussion and Conclusions

Evaluation and comparison of the effectiveness of the different systems of belts tested in the experiment can best be made in terms that consider both the level of velocity reduction and the type of protection afforded by a given system of belts. The spacing-effectiveness curves shown on the figures were of considerable value in determining the spacing interval; however, they do not provide sufficient information to give a true evaluation of the merits of a given belt system. A better method is one that considers the desired level of velocity reduction, the location and the net size and extent of the protected area. The level of velocity reduction previously has been chosen as 50 or 75 percent in this study. The size of the protected areas can be evaluated, therefore, in relative terms by determining the areas on the profile maps between belts and under the 50 or 75 percent reduction curves. The extent of protection can be determined in terms of the net distances[3] along the ground between belts having at least 50 or 75 percent reductions in velocity.

Table 1 summarizes the information obtained on all the shelterbelt combinations tested. The data is presented in terms of "best" spacing intervals, areas of protection, and extent of protection.

Table 1 indicates that a 50 percent reduction is obtained for 77.4 percent of the total area between the 7-row principal and two 1-row supplementals. This area is approximately 8 percent greater than the next best combination and about 44 percent greater than the poorest combination, the 3-row principal with 1-row supplementals. The 7-row plus 1-row also has 46.9 percent of the area with a reduction of at least 75 percent or 2.7 percent more than the 7-row with 2-row supplementals. The 7-row plus 1-row areas, however, are slightly smaller in actual size than the 7-row plus 2-row areas. (Cols. 6 and 8.) Since the spacing interval is shorter for the 7- plus 1-row, this indicates that the 50 percent velocity reductions extend to greater heights above the ground for this combination than the 7- plus 2-row. Choices between these two belts would depend, therefore, on whether surface protection or protection to some height above the ground was desired. Other belts would be ranked in the order in which they are listed in the table.

In terms of "best" spacing interval and extent of protection, the system of belts consisting of a 7-row principal with 2-row supplementals gives a spacing interval of 22- and 14-*H* and 14- and 7-*H* for a 50 and 75 percent reduction, respectively. This system would utilize a total length of 39.0 heights for the best 50 percent spacing; 34.6 heights, or 88.7 percent of this

[3]Net distance is defined as the length of protected area after deductions for the length of ground used by the belts and for those areas immediately to the leeward of the belt where velocities do not reach the desired level of reduction because of the air jets.

length, would have at least a 50 percent reduction. Similarly, the system would use 24 heights with the best 75 percent spacing and 18.4 *H*, or 76.6 percent of this length, would have a 75 percent reduction. In terms of net distance with a 50 percent reduction, this belt provides protection to a length approximately 6 *H* longer than the 7-plus 1-row, 5 *H* longer than the 7- plus 3-row combination, and 12 and 25 *H* longer than the 1- plus 1-row and the 3- plus 1-row combinations. It also has a slight advantage over the other belts in terms of length having a 75 percent reduction. On a basis of information given by these data, then, the 7-row principal with 2-row supplementals would be the best combination, followed by the 7- plus 1-row, the 7- plus 3-row, the 1- plus 1-row, and the 3- plus 1-row.

The so-called "narrow" plantings tested in this experiment were not so effective as the wider principal belts followed by supplementals. The 3-row principal in particular did not show up well and probably should not be considered for most problems. It is apparent that the rather abrupt top design obtained when placing a shrub row and then two rows of much taller trees is not a good design for maintaining substantial reductions to the lee of the belts. It is possible, however, that if a better arrangement of trees was made within the belts, some better protection could be obtained. The other narrow plantings tested, the single-row belts, were considerably better than the 3-row belts. In terms of the ratio of protected length to total length utilized, the single-row system ranked very well. The spacing intervals for a 50 percent reduction, particularly aft of the first supplemental compared favorably with that obtained with the wider principal belts. A 75 percent reduction could not be maintained with this system. This combination could be used where field arrangements would permit growing of crops needing less protection between the principal and first supplemental. In these cases this system would also have considerable appeal because of the smaller number of trees needed and the consequent reduction in cost and labor required for establishing and maintaining the belt.

In conclusion, it appears that the 7-row principal followed by a system of 1-row supplementals probably would give the greatest proportion of protection at greater distances above the ground level. Possible application of this system would be protection for tall growing crops, orchards, homes, and livestock. On the other hand, the 7-row principal followed by a system of 2-row supplementals would give the best ground protection. Use of this system would be indicated for problems concerned with minimizing soil blowing. The 7-row principal followed by a system of 3-row supplementals would rank third in the group tested. The single-row system would be recommended for special problems with the reservations described in the previous paragraph. The 3-row principal plus 1-row supplementals would not be recommended.

The above conclusions are based on the data obtained in this particular experiment. The study was concerned only with the mechanical reduction of wind velocity and, therefore, ignores the silvicultural problems associated with shelterbelts. Suffice to say that final selection of a shelterbelt system for a particular problem can only be made after careful consideration of both aspects of the problem.

Summary

Wind tunnel studies were conducted to obtain information on the mechanical reduction of wind velocity and a system of shelterbelts consisting of a principal belt followed by supplemental belts.

TABLE 1.—SUMMARY OF INFORMATION AND COMPARISON OF BELT COMBINATIONS TESTED. INDICATED 50 AND 75 PERCENT REDUCTIONS ARE THOSE OBTAINED WITH "BEST" 50 AND "BEST" 75 PERCENT SPACINGS, RESPECTIVELY

Belt combination	"Best" spacing interval between				Area between belts with reduction of				Total distance in system[2]		Distance used by tree rows[3]	Net-distance protected and percentage of total with reduction of			
	Prin. and 1st supp.		1st and 2nd supp.		50%		75%		50%	75%		50%		75%	
	50%	75%	50%	75%											
	H	*H*	*H*	*H*	H^2	%	H^2	%	*H*	*H*	*H*	*H*	%	*H*	%
7-row prin. plus two 1-row supp.	19	13	11	6	25.0	77.4	10.0	46.9	32.3	21.3	3.0	28.3	87.6	16.3	76.5
7-row prin. plus two 2-row supp.	22	14	14	7	27.2	69.8	10.6	44.2	39.0	24.0	3.7	34.6	88.7	18.4	76.6
7-row prin. plus two 3-row supp.	20	13.5	12	6	23.2	65.0	8.0	34.5	35.7	23.2	4.3	30.1	84.3	13.9	59.9
1-row prin. plus two 1-row supp.	17	[1]	13	—	17.0	56.1	—	—	30.3	.....	1.0	22.1	73.0	.....	.....
3-row prin. plus two 1-row supp.	12	[1]	12	—	8.4	33.6	—	—	25.0	.....	1.7	9.3	37.2	.....	.....

[1]Single and 3-row principals did not produce a continuous 75 percent reduction; therefore, no "best" spacing interval tests were run.

[2]Total distance includes spacing between and within belts plus one-half of a row width added to the outside of both the first and last belt in a system. One row width is the distance between rows and is equal to 0.333H.

[3]Sum of distance between rows in belts plus one-half of a row width to either side of a given belt. A 1-row, 2-row, 3-row and 7-row belt would, therefore, be 0.333H, 0.666H, 1.0H, and 2.333H wide respectively.

Models of 7-, 3-, and 1-row principal belts, and 1-, 2-, and 3-row supplemental belts were used to obtain the information. Results are expressed in terms of percentage reductions of the open wind velocity. Information was obtained with several different spacings of the supplemental belts when used with a principal belt. Some results of tests on the so-called "narrow" plantings, i.e., single rows used without the benefit of a wide principal belt, are also given.

The degree of efficiency of a given system of belts depended somewhat upon the type of protection desired. Of the belts tested, a 7-row principal followed by a system of 1-row supplementals would give the greatest degree of protection extending to the greatest height above ground between belts. This system would be most applicable to problems of protection for tall crops, orchards farmsteads, and livestock. On the other hand, a 7-row principal belt followed by a system of 2-row supplementals would permit the greatest spacing intervals between belts and would provide protection to the greatest length of ground. Use of this system would be indicated for problems concerned with minimizing soil blowing. A 7-row principal belt followed by a system of 3-row supplemental belts would rank third in the group tested. Single rows of trees used without benefit of a wide principal belt would not reduce wind velocity as much as the wider belts. However, at lower levels of velocity reduction, they would permit fairly long spacing intervals and would provide a relatively high ratio of protected length to total length used by the system. They would be recommended for special problems where less protection from wind is required and where the area used by the belt would be an important factor. The 3-row principal followed by 1-row supplementals did not show up well in the tests and would not be recommended.

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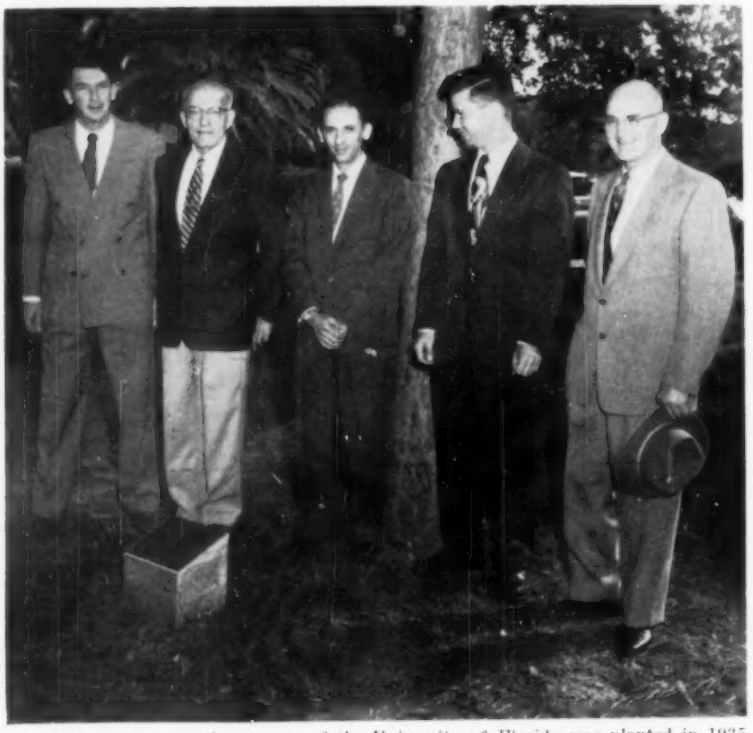

A SLASH PINE tree on the campus of the University of Florida was planted in 1935 to mark the establishment of the 4-year curriculum in the School of Forestry. Commemorating this event 20 years later, in November 1955, a bronze marker was dedicated. Shown above at the dedication ceremony are, left to right: Wayne L. Haines, forester, Xi Sigma Pi, School of Forestry; Harold S. Newins, director-emeritus, School of Forestry; Philip J. Moses, president, School of Forestry Alumni Association; Daniel W. Hausman, president, Forestry Club, School of Forestry; C. M. Kaufman, director, School of Forestry.

The tree is now 48 feet tall and 8.9 inches in diameter.

Forest Inventory for Management of State Lands in Minnesota

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A NEW METHOD of forest survey was initiated on state-owned lands in Minnesota in 1952. This survey considers the individual forest type as the basic unit. For purposes of clarity, this basic unit will hereafter be referred to as the *type*. A *type* is a contrasting area of vegetation of a minimum size of one acre. Each type is dealt with separately. All information pertaining thereto is punched into an IBM card or cards. Information recorded in all cases is as follows:

1. Location by management unit, compartment and legal description.

2. Type identity—each type area is assigned a letter to distinguish it from other types with the same type classification.

3. Kind of state ownership—this information is necessary, since income from trust lands, acquired lands, etc., is deposited in separate funds and appropriations and disbursements are governed by various laws and regulations.

4. Cover type (condition class in the case of timber producing types).

5. Acreage.

6. Land use—whether conservation, agricultural, industrial, or recreational.

7. Forest development or stand improvement needs—if applicable. For all timber producing types the following additional information is recorded:

8. Site and main stand age.

9. Understory and understory age, for merchantable types.[1]

10. Stand vigor and condition—merchantable stands are classed as deteriorating, storage, or growing and good or poor condition, to provide for possible reassignment of cutting priority.

11. Stand operability—merchantable stands are classed as good, poor, or nonoperable, based on factors such as volume per acre, location, species, composition, terrain, age, and condition.

12. Cutting priority and volume by species.

An important consideration in this survey is the "write off" of volume, which is in the harvest class but classified as nonoperable. This is discussed at length further along.

[1]Merchantable types must contain at least three cords per acre in pole stands (5"-9" d.b.h.) and 1,300 board feet in saw-timber stands (9" + d.b.h.).

History

Approximately 2,360,000 acres of a total of 4,750,484 acres of state-owned land in the forest area have been placed under management. Prior to 1952 ten management units, comprising some 1,850,000 acres, were inventoried by a random sampling method. Policy statements were prepared for each management unit listing type acreages, volumes, allowable cut, and general management plans. Printed type maps were prepared from aerial photographs as a part of the record.

It became necessary for the forester in charge to make an intensive reconnaissance of the unit to locate stands in need of cutting and to develop long range plans for stand improvement and forest development work. A one man reconnaissance of this magnitude requires years and with other necessary work projects, may never be wholly completed. In addition, many errors of photographic interpretation were revealed, some seriously affecting original inventory figures on acreage and volume. The printed type maps proved impractical, since corrections soon rendered them almost illegible. It became obvious that new procedures were in order.

In 1952 two "pilot" projects were undertaken employing a new survey technique. The Solana and Quadna Units of 58,000 and 80,000 acres respectively were type mapped from aerial photographs by the district forester prior to any field work. The field work consisted of field checking and sampling *every* merchantable type in the unit. Other types were field checked, whenever encountered. Field and office procedures were developed and improved upon in the course of the work.

In 1953 the Black Bay Unit, in the Rainy Lake region, on the Canadian border was inventoried and survey techniques were further improved. This survey covered 136,000 acres of state land and employed a nine-man crew. At the present time two resurveys are in progress in line with department policy of reassessing management units on a ten year cycle. The resurveys, when complete, will bring the total area covered by the new method to some 580,000 acres. Reassessment of units surveyed by the new method will be on a fifteen year cycle.

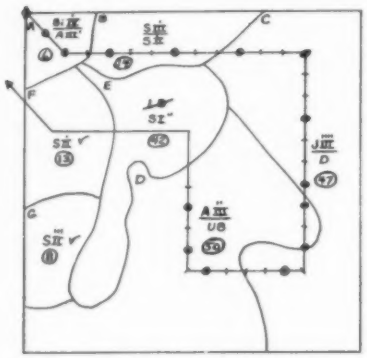
Procedure

State-owned lands are carefully type mapped from the most recent aerial photography available on Matex overlays. The amount of field checking necessary at this stage is inversely dependent upon the skill of the interpreter and his familiarity with the area. The job is therefore given to the district forester alone. Analysis of past projects in Minnesota indicates that for planning purposes 2,500 acres per day can be type mapped from aerial photographs. One of the basic reasons for adopting this survey method was recognition of the inherent errors in photographic interpretation of forest types and condition classes. These errors are practically negated in merchantable stands and are minimized in other types through a sampling correction procedure. As mentioned previously, types other than merchantable are field checked whenever encountered. A listing of nec-

essary corrections coupled with further examination of the aerial photographs, permits a percentage correction of final acreage figures for all nonmerchantable cover types and condition classes.

The field work is carried out with two-man crews and a chief-of-party. The chief-of-party is responsible for the overall conduct of the survey and makes daily assignments, inspects field work, organizes office work, and manages the survey camp. Each field crew is made up of an estimator, who *must* be an experienced forester and a compassman who does the tallying. One crew stays in camp whenever necessary to keep office work current.

Each day the crew prepares the day's run, laying out a course of travel on the type map overlay from a well defined starting point. The course of travel intersects all merchantable types. Care is taken to avoid following drainage patterns, contours, and type edges. Elongated type areas are crossed at least twice, at right angles. The course line is marked at five chain intervals to establish plot locations. A plot is taken at the first location point in each merchantable type and at as many other locations within the type as deemed necessary by the estimator. The goal is for a one percent sample but this may vary widely in certain type conditions. To avoid bias the location of all subsequent plots is predetermined on a systematic basis (Fig. 1).


A
B
C
D
E
F
G
SI
SI
SI

RADIUS 1/10 ACRE - 37.2 FEET

CUMULATIVE 1/5 ACRE TALLY SHEET

RADIUS 1/5 ACRE - 52.7 FEET

ITEM AND CODE	COL. NO.	ITEM AND CODE	COL. NO.	ITEM AND CODE	COL. NOS
Descr. _ _ _ _ _ _ _	1-7	Class of Land _	17	Age - overstory _ _	27-28
Mgmt. Unit _ _	8-9	Acreage _ _ _ _	18-20	Age - understory _	29
Comp. No. _ _	10-11	Understory _ _ _ _	21-24	Site _	30
Type No. _	12	Type Class _	25	For. Dev. _	31
Cond. Cl. _ _ _	13-16	Operability _	26	Land Use _	32
				Cause - acreage loss _	33

DBH | SPEC | NUMBER OF 8 FOOT BOLTS (3" TOP DIA.) PER TREE | DEFECT: SPEC. | % | NO. OF PLOTS

4
6
NUMBER OF 8 FOOT BOLTS (4" OR LARGER) PER TREE
6
8
10
12
14
16
18
20
22
24

VOLUME IN TENTHS OF CORDS PER ACRE

1/50 ACRE PLOT	RADIUS - 16.6 FEET			
DBH				
2				
4				

SPECIAL PRODUCTS TALLY		

COLUMN NO. DATA FOR CORDWOOD SPEC.	
Aspen	33-37
Balsam Fir	38-42
Black Spruce	43-47
Jack Pine	48-52
Tamarack	53-57
White Spruce	58-61
Balm of Gilead	62-66
White Pine	67-70
Norway Pine	71-74
Misc. Hdwds.	75-79

SPECIES	VOLUME - CORDS		COLUMN NOS.	CUTTING PRIORITY VOL. CODE

FIG. 2.—Combined plot tally and keypunch sheet. One of these sheets is used for every type. The data from this sheet is punched into an IBM card.

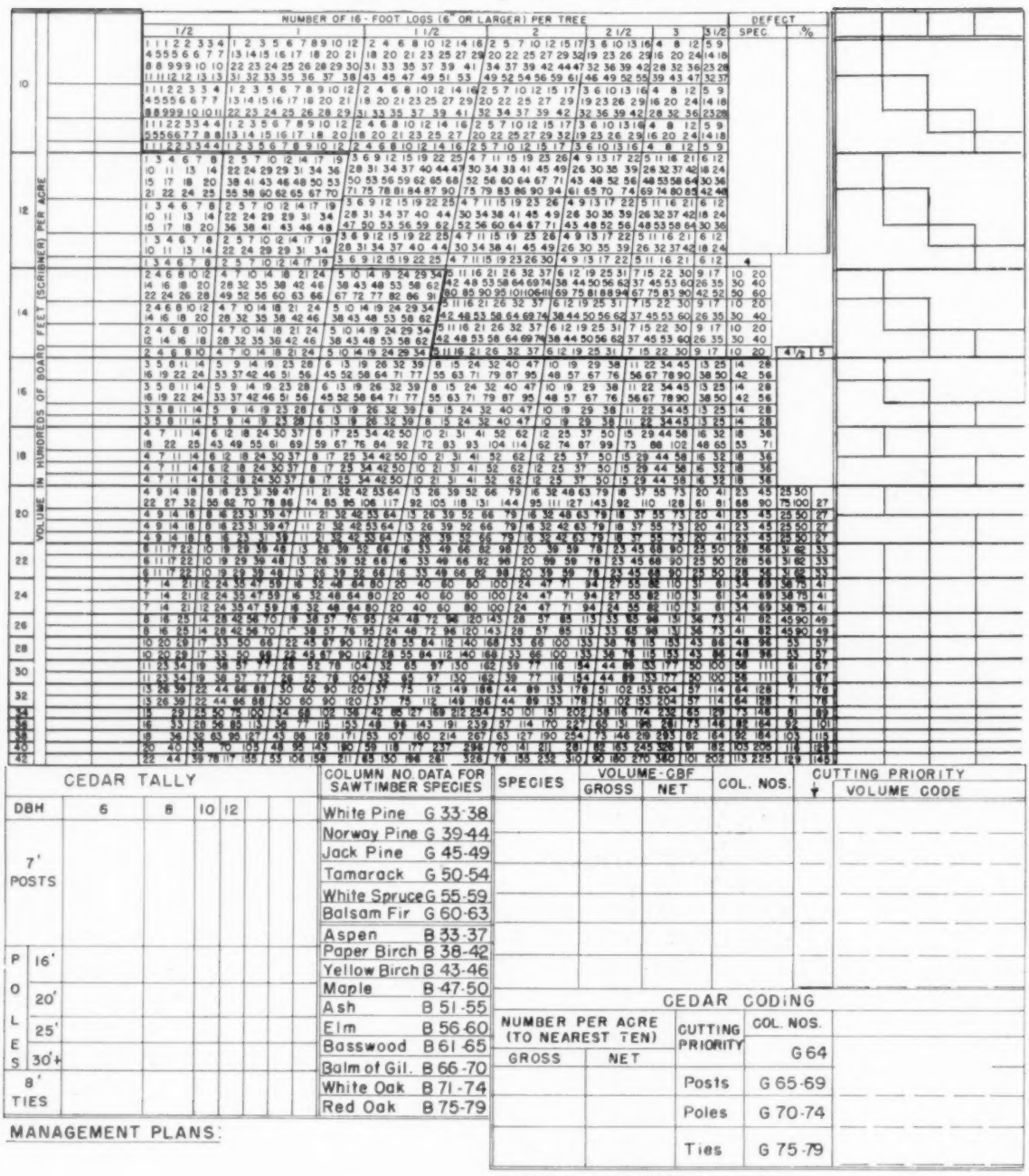


FIG. 3.—Back of sheet (Fig. 2). This side is filled out for any type containing board-foot volume or cedar products. The G and B under coding data refer to the color of IBM card to use since two attachment cards may be necessary to obtain sufficient columns.

TABLE 1.—COST OF SURVEY

	Solana	Black Bay	Savanna[1]	Nemadji
Merchantable area (acres)	15,601	35,761	26,517	7,400
Total forest area (acres)	55,028	133,296	95,199	24,329
Total cost in dollars	$ 4,885	$ 14,950	$15,420	$ 4,380
Cost per acre of merch. area	31¢	42¢	58¢	59¢
Cost per acre of total area	8½¢	11¢	16¢	18¢

[1]Original inventory costs were computed at 4¢ per acre, but represented a complete lack of individual stand information, which is vital to intensive management planning. Cost as shown includes subsequent intensive type reconnaissance.

tabulations are as sound as the one percent area cruise but become statistically weakened in very fine breakdowns.

This type of survey, when repeated every fifteen years, will give excellent data on growth trends, acreage changes by cause, volume drain by cause, changes in site condition, etc.

Records

Experience has taught that the simplest records are by far the best. The record system set up under this survey fits the conception perfectly. The records kept include a wall map of the management unit, a file of management cards (Fig. 4 and 5), a drain record book, and the IBM card file. All other original data such as field maps, tally sheets, etc., are stored away.

The wall map record includes a display of cutting areas color coded according to cover type.

Management cards are filed by township and range. The McBee key-sort system is used for cross-filing purposes. Under remarks on the back side of the card (Fig. 5) is the key to essential information. The same sequence is always maintained. Under type A the code 2PP70G CCO-15 is interpreted as 2-storage class, P—poor condition, P—poor operability, 70—age in years, G—good site, CCO-15—clearcut within 15 years. Under type C the code PCO-15 (25) means partial cut approximately 25 percent within 15 years. All entries are with erasable pencil to readily facilitate changes in map or volume data.

Entries of total volume drain by cause and species and total acreage drain by cause and cover type are made annually in the timber drain record book. This record also lists the recommended annual cut and volume and acreage balances for the period of the management plan. In view of the excellent acreage date on merchantable stands, drain by cause may be obtained in a relatively satisfactory manner through the use of fire records, extensive ground reconnaissance and occasional aerial reconnaissance. Loss of acreage directly affects volume losses, which may be estimated from individual stand data on the management cards.

Cost of Survey

This survey, which is very comprehensive, is the cheapest of all methods that have been employed by the Division of Forestry for management planning. A comparison of costs is shown in Table 1.

The Solana and Black Bay Units were inventoried by the new method of survey. The Savanna Unit was inventoried in 1947 with a random sampling procedure and cost figures include subsequent field checking. The Nemadji Unit was inventoried by the horseshoe method and cost figures do not include total cost of computation, which is not yet completed. Information on the two latter units is not nearly so comprehensive nor recorded as efficiently as on the Solana or Black Bay Units.

State-Wide Inventory

For a number of years the need for a continuous inventory of Minnesota's 5 million acres of state-owned land has been recognized. The project has been deferred through lack of funds and personnel and through lack of a survey method that met all of the requirements for realistic management planning.

In August, 1954 a state-wide inventory was undertaken in Minnesota and by January 1955 was complete. The same survey method as described heretofore was employed, with two important modifications. Firstly, a one percent area sample was achieved by a systematic selection of 1,162 "forties" of state land over the entire forested region. Secondly, one permanent one-fifth acre plot was established in each merchantable type.

Each forty, (which is occasionally an odd-sized survey lot) was located, permanently marked at one corner, very carefully type mapped (with the aid of aerial photographs) and inventoried in the same manner as for the management survey. The plot in each merchantable type was located by a priority location scheme to avoid bias. Map type and plot type frequently differ, so stock tables are prepared for each condition class (by IBM methods).

Plots are center marked with a short Penta-treated stake and each tree of a specified minimum diameter is recorded and paint-spotted. Culls and dead trees are marked with an X. The plot is recorded on a 1/5 acre cumulative tally sheet and each species is assigned an estimated percent of defect if applicable.

As in the management survey, the individual type is the basic survey unit. An IBM key punch sheet is prepared for each type. All data on age, cutting priority, understory, etc., pertains to the stand rather than the single plot therein.

Plot sheets, maps and key punch sheets were all carefully cross-checked at a central point and the key punch sheets sent to the IBM center. Cards were key punched and check listed. The check listings were carefully scrutinized and where errors or omissions were found the card was corrected.

The original cards for merchantable types contain the plot volumes per acre. From these cards, a stock table for each condition class was prepared. A new deck of cards

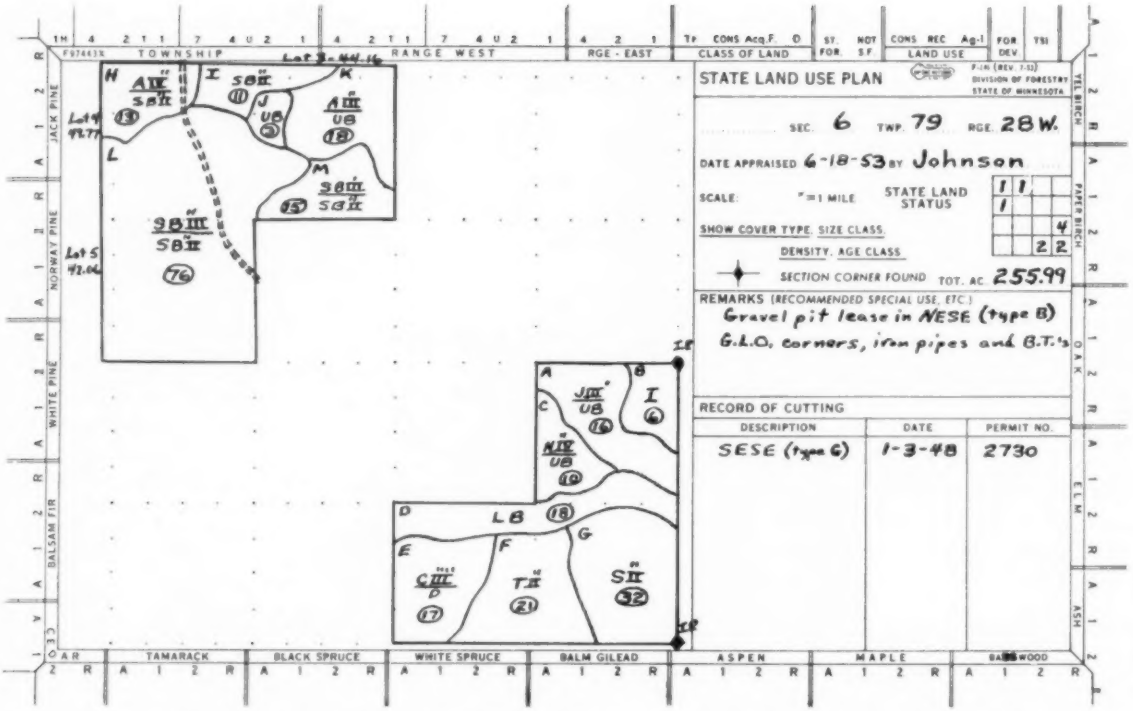


FIG. 4.—Management card (front). Type identity letters are color coded to indicate type cutting priority. The code in state land status refers to class of state ownership (1—trust fund, 2—conservation, 4—acquired forestry, etc.).

TIMBER APPRAISAL, CONDITION

TYPE NO.	COVER TYPE SYMBOL	TYPE AREA	SPECIES AND VOLUME (USE SEPARATE COLUMNS FOR EACH STANDARD OF MEASURE, I.E. CORDS, M.B.F., ETC.)														REMARKS
			JP	NP	BF	CORDS A	WS	WP		NP	WS	M. BOARD FEET A	WP		PIECE PRODUCTS Pb	Ps	T	
A	J III	16	70															2PP70G CC0-15
C	N IV	10		15						32			3					3GG70M PC0-15(25)
E	C III	17													110	1420	185	1PG90G PC0-5(76)
H	A IV	13			20	16						42	11					1GG4%0G PC0-15 Res WP
K	A III	18				180												2GP30M Reserve
L	SB III	76			470	130	84	30			46							3GG5%0M PC0-15(25)
M	SB III	15			64	20												4GP30/30G Reserve

FOREST DEVELOPMENT PLANS (PLANTING — TYPE AND SPECIES, DISCING, ETC. — BY TYPE)
Machine plant type J - Wh. Spr.
Disc type C prior to partial cut.

PLANTING RECORD

RECENT DATE	BURNS FIRE PROJECT NO.	ACRES
4/16/51	19	2

FIG. 5.—Management card (back). Volumes listed are total for each type. Code scheme under remarks is explained in the text.

then had all type information gang punched. Total volume for each type was computed from the applicable stock table and punched into the appropriate card. This latter step was necessary to facilitate sorting and summation by any set of volume factors desired.

This survey was based on 1,212 permanent volume plots and 46,157 acres of area sample. Statistically it is very sound. All of the important breakdowns are accurate enough for management planning on a state-wide basis. Subsequent remeasurements will provide a reliable measure of change of forest conditions throughout the state ownership.

Remeasurement will involve a duplication of the original measurement in that each forty will be carefully type mapped from aerial photographs and verified in the field. Original plots will be remeasured providing they remain in a type area classed as merchantable. New plots will be established in any new merchantable types (ingrowth).

Any changes in the stock tables over the first few measurements will most likely reflect small mechanical and statistical errors, but over a long series of remeasurements will provide a good measure of management practices in the various condition classes.

This survey is designed to carefully measure acreage change by cover type and condition class. The data from the most recent measurement will be taken into the field at the time of remeasurement to assess type acreage change by cause.

Summary

The advantages of this method of forest survey for management planning are as follows:

1. The individual stand as the basic survey unit is in complete accord with the stand selection method of forest management as practiced in this region.

2. Use of the individual type as the basic unit provides for a very flexible and reliable analysis and summarization of field data.

3. Valid acreage data is obtained through complete type mapping from aerial photographs and field checking all merchantable stands as well as many other types.

4. The data obtained for management planning and execution may be incorporated into very comprehensive but simple records.

5. Complete data for management planning is available immediately following field work.

6. Survey costs for obtaining comprehensive stand information, on each stand in a management unit, are less when compared with other survey methods.

7. Possibililty of error has been minimized through use of IBM in computation and qualified experienced foresters in the gathering of data.

Coming Events

Allegheny Section

The Allegheny Section, S.A.F., meets February 10-11 in the Bellevue-Stratford Hotel, Philadelphia, Pa.

American Pulpwood Association

The A.P.A. will hold its annual meetings in the Waldorf Astoria Hotel in New York City, February 21-22.

Midwestern Shade Tree Conference

The Midwestern Chapter of the National Shade Tree Conference will hold its annual meeting February 22-24, 1956, in the LaSalle Hotel, Chicago, Ill.

Wisconsin-Michigan Section

The Wisconsin-Michigan Section will hold its winter meeting Feb. 24-25 in Escanaba, Mich. The meeting will be devoted to the subject of genetics.

Wildlife Conference

The 21st North American Wildlife Conference will be held March 5-7 in the Jung Hotel, New Orleans, La.

Southern Forest Fire and Woods Arson Conference

Sponsored by national and southern forestry and industrial groups, the Southern Forest Fire and Woods Arson Conference will be held April 12-14 in the Roosevelt Hotel, New Orleans, La.

New England Section

The New England Section will hold its annual meeting March 8-9 at the Hotel Somerset in Boston, Mass. The program will deal with forest plantations and their place in government and private policies of forest management.

Effects of Thinning a 55-Year-Old Western White Pine Stand

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THE FIRST experiment in thinning western white pine (*Pinus monticola* Dougl.) was planned and established by J. A. Larson and D. R. Brewster in 1914 in a 55-year-old stand on the Priest River Experimental Forest, Idaho. It was designed to compare the effects of three thinning treatments on volume and quality growth, and on total volume production with an unthinned stand. As thinnings of saw-log material in this species are becoming salable, it is desirable to know if production can be increased by this early stand treatment and, if so, to what extent.

A forest owner or manager might hope for several benefits from thinning: first, an immediate cash income from the thinned material; second, increased total growth and production of wood during the rotation period; third, improved quality resulting in higher value at the time of harvest; and fourth, increased diameter growth, which will shorten the rotation.

Western white pine commonly occurs in various mixtures with as many as eight other species. In this stand, western larch (*Larix occidentalis* Nutt.) was the chief associate of white pine—60 percent of the dominants were larch; 30 percent were pine—with minor numbers of Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco), grand fir (*Abies grandis* [Dougl.] Lindl.), western hemlock (*Tsuga heterophylla* [Raf.] Sarg.), western redcedar (*Thuja plicata* Donn), lodgepole pine (*Pinus contorta* Dougl.), and Engelmann spruce (*Picea engelmannii* Parry). Thus the stand was typical of natural stands in the northern part of the white pine range. It was situated on a low level bench of site index 58 feet at 50 years, which is good for white pine.

Four permanent sample plots, each one-half acre in size, were established and treated as follows:

Plot 101. Left unthinned as a check area.

Plot 102. Thinned three times. The 1914 thinning removed most of the intermediate and suppressed trees and enough of the inferior dominants to provide increased growing space for the remaining trees for 10 years. The second thinning, in 1924, removed those trees needed to free the remainder for another 10 years. The third thinning, in 1934, eliminated all trees except those intended for the final crop.

Plot 103. Thinned twice, in 1914 and 1934. The result of each of these two thinnings was intended to be the same as on plot 102, but the stand was thinned in two stages instead of three.

Plot 104. One severe thinning in 1914 left only those trees that the marker felt would produce a maximum crop of saw timber at the end of the rotation.

In each of these thinnings, the cedar understory was left intact except that trees damaged during the thinning operation were removed. The primary purpose of the thinnings was to increase the growing space of selected crop trees; no conscious effort was made to alter species composition.

Measurements at 5-year intervals show the effect of these thinnings for 35 years. Tables 1 and 2 present the volume removed, mortality, and growth on the plots from 1914 through 1949.

Although the plots were generally comparable at the time of establishment, they varied somewhat in stocking. Because of this variation and the fact that no replications were installed, it is impossible to assess accurately the effects of the thinnings. However, until analyses of additional plots are available, it

[1] Forest Service, U. S. Dept. Agric.

TABLE 1.—NUMBER OF TREES AND BASAL AREAS PER ACRE FOR ALL SPECIES, PRIEST RIVER 1914 THINNING PLOTS[1]

Item	Plot 101 unthinned		Plot 102 thinned three times		Plot 103 thinned twice		Plot 104 thinned once	
	No. trees	Sq. ft. basal area	No. trees	Sq. ft. basal area	No. trees	Sq. ft. basal area	No. trees	Sq. ft. basal area
Stand								
1914 before thinning	1,068	156	1,824	156	1,252	140	1,384	174
1914 removed in thinning			1,274	60	798	49	1,068	79
1914 after thinning			550	96	454	91	316	95
1924 before thinning	924	178	528	130	424	123	300	119
1924 removed in thinning			138	19				
1924 after thinning			390	111				
1934 before thinning	772	190	382	137	410	146	274	134
1934 removed in thinning			124	29	142	40		
1934 after thinning			258	108	268	106		
1949	626	221	250	151	252	143	268	166
Mortality 1914-1949	442	45	38	5	60	9	48	11
Gross annual increment 1914-1949		3.1		3.1		2.9		2.3
Net annual increment 1914-1949 (excluding mortality)		1.9		2.9		2.6		2.0
Net annual increment 1914-1949 (excluding mortality and thinnings)		1.9		−0.1		.01		−0.2
Total production		266		264		241		256

[1] Includes all trees 0.6 inch d.b.h. and larger.

TABLE 2.—CUBIC- AND BOARD-FOOT VOLUMES PER ACRE FOR ALL SPECIES, PRIEST RIVER 1914 THINNING PLOTS[1]

Item	Plot 101 unthinned		Plot 102 thinned three times		Plot 103 thinned twice		Plot 104 thinned once	
	Cubic feet	Board feet	Cubic feet	Board feet	Cubic feet	Board feet	Cubic feet	Board feet
Stand								
1914 before thinning	3,431	4,414	3,063	2,530	2,970	2,512	3,872	4,648
1914 removed in thinning			929	516	834	702	1,489	1,200
1914 after thinning			2,134	2,014	2,136	1,810	2,383	3,448
1924 before thinning	4,753	8,650	3,497	6,056	3,372	5,000	3,527	7,822
1924 removed in thinning			400	98				
1924 after thinning			3,097	5,958				
1934 before thinning	5,750	12,874	4,260	11,214	4,529	10,280	4,372	12,672
1934 removed in thinning			773	640	1,112	1,184		
1934 after thinning			3,487	10,574	3,417	9,096		
1949	7,613	22,892	5,625	21,532	5,187	18,538	5,978	21,450
Mortality 1914-1949	1,043	2,514	108	70	221	258	270	290
Gross annual increment 1914-1949	149	600	136	581	125	519	110	523
Net annual increment 1914-1949 (excluding mortality)	119	528	133	579	119	512	103	514
Net annual increment 1914-1949 (excluding mortality and thinnings)	119	528	73	543	63	458	60	480
Total production	8,656	25,406	7,835	22,856	7,354	20,680	7,737	22,940

[1]Cubic-foot volumes include all trees 0.6 inch d.b.h. and larger. Board-foot volumes were computed from total height volume tables based on the Scribner Decimal C log rule. Minimum diameters used in computing board-foot volumes were 7.6 inches for white pine and 9.6 inches for other species.

is believed this information will serve as a useful guide in thinning white pine stands.

Effects of Thinning

In this test, the thinning treatments failed to increase the gross volume production above that of the unthinned stand (Table 2). The volume of standing timber 35 years after thinning was greater on the check plot than on any of the thinned plots. Also the total volume of wood produced in 90 years was greater on the check plot. However, a much larger share of the production has been lost through mortality on the check plot. If mortality is deducted from the gross growth, plot 102, which was thinned three times, shows an annual increment of 133 cubic feet compared to 119 feet on the check plot, 119 feet on plot 103, and 103 feet on plot 104. Therefore, if the material removed were merchantable, conservative thinning would enable the forest owner to receive an immediate income from the land by harvesting potential mortality and at the same time increase the total yield.

At present, thinned material, except that of saw-log size, is seldom merchantable and therefore is lost just as mortality is lost. If both mortality and the thinnings are deducted from the gross growth, the net board-foot increment shows an advantage for the stand thinned three times, but the net cubic-foot increment is greatest on the unthinned plot. The difference between board-foot and cubic-foot increment leads to the conclusion that growth on the thinned plot was made on fewer but larger trees whereas growth on the check plot was divided among numerous small trees. This is a distinct and important advantage of thinnings.

Since the material removed in low thinning is generally unmerchantable and the volume production following thinning is no greater than in unthinned stands, any benefits derived from such thinnings must come from improved quality of the final product or from a shortened rotation. One way in which thinning can enhance the value of a stand is through improving the species composition so that growth is concentrated on stems of the most valuable species. Improved composition is especially important when the difference in value between species is as large as it is in the white pine type. Although no special effort was made in this test to improve species composition, all the treatments did increase the proportion of high-value white pine in the stand (Table 3). The repeated light thinnings, which increased the proportion of white pine by 20 percent, proved more effective than the single heavy thinning, which resulted in only an 8-percent increase. The proportion of white pine in the unthinned stand remained nearly constant during the 35-year period.

TABLE 3.—EFFECT OF THINNING ON STAND COMPOSITION

Plot	Proportion of white pine cubic-foot volume in total stand		
	1914 Before thinning	1949	Increase
	Percent	*Percent*	*Percent*
101	40.9	42.5	1.6
102	41.4	62.7	21.3
103	26.1	45.6	19.5
104	27.3	35.1	7.8

The actual growth and production of white pine following thinning is probably more meaningful than the proportional composition of the stand by species (Table 4). Plot 102, thinned three times, has shown a net annual growth of 407 board feet of white pine per acre, or 158 feet more than the check plot. The net periodic annual white pine cubic-foot growth on plot 102 was 64 cubic feet, or 12 cubic feet greater per acre than that on the check plot. Neither of the other two thinned plots equalled the growth of the check plot. The in-

TABLE 4.—CUBIC- AND BOARD-FOOT VOLUMES PER ACRE FOR WHITE PINE ONLY, PRIEST RIVER 1914 THINNING PLOTS[1]

Item	Plot 101 unthinned		Plot 102 thinned three times		Plot 103 thinned twice		Plot 104 thinned once	
	Cubic feet	Board feet	Cubic feet	Board feet	Cubic feet	Board feet	Cubic feet	Board feet
Stand								
1914 before thinning	1,402	2,350	1,268	1,350	775	734	1,058	1,288
1914 removed in thinning			291	104	185	158	400	174
1914 after thinning			977	1,246	590	576	658	1,114
1924 before thinning	2,113	4,510	1,745	4,138	1,101	1,926	1,072	2,600
1924 removed in thinning			126	0				
1924 after thinning			1,619	4,138				
1934 before thinning	2,598	7,302	2,345	7,910	1,613	4,632	1,370	4,524
1934 removed in thinning			276	192	178	148		
1934 after thinning			2,069	7,718	1,435	4,484		
1949	3,232	11,080	3,520	15,598	2,866	9,318	2,096	8,408
Mortality 1914-1949	691	2,018	66	70	100	258	94	70
Gross annual increment 1914-1949	72	307	86	418	59	261	44	210
Net annual increment 1914-1949 (excluding mortality)	52	249	84	416	56	254	41	208
Net annual increment 1914-1949 (excluding mortality and thinnings)	52	249	64	407	45	245	30	203
Total production	3,923	13,098	4,279	15,964	2,829	9,882	2,590	8,652

[1]Cubic-foot volumes include trees 0.6 inch d.b.h. and larger. Board foot volumes were computed from total height volume tables based on the Scribner Decimal C log rule. Board-foot volumes include trees 7.6 inches d.b.h. and larger.

creased production of white pine resulting from thinning may be important to a forest owner who must grow as much high-value white pine per acre as possible to offset an investment in blister rust control.

One outstanding benefit from thinning is increased diameter growth which shortens the rotation. All the treatments in this test stimulated the diameter growth of trees in the dominant and codominant crown classes at the time of thinning (Table 5).

Increased diameter growth following thinning has not been sufficient, however, to change the diameter distribution pattern to a marked degree. This is illustrated in Table 6, which shows numbers of trees 10 inches and larger within diameter classes. The data show little difference between the number and distribution of merchantable sized trees on the four plots 35 years after thinning. This distribution is largely influenced by their arrangement in 1914 when plots 101 and 104 contained more large trees than the other two plots. Nevertheless, thinning has not greatly altered that distribution.

Conclusions

Results of this single test provide some useful information on thinning western white pine, but they are not conclusive.

The thinnings had little effect on total volume production but enhanced the value of the stand by increasing the proportion of high-value white pine in it. They stimulated diameter growth of dominant and codominant stems but not at a rate that resulted in an appreciably greater number of larger diameter trees than on the check plot.

Because white pine was exceeded initially by other species, it is possible that an early weeding to correct composition followed by frequent thinnings would prove more beneficial eventually. Analyses of data from other plots, established later than those described above, will complement these results and provide additional information for the management of young white pine stands.

TABLE 5.—DIAMETER GROWTH OF DOMINANT AND CODOMINANT TREES FOLLOWING THINNING

Plot	Western white pine			Western larch		
	Average d.b.h. 1914	Average d.b.h. 1949	D.b.h. growth	Average d.b.h. 1914	Average d.b.h. 1949	D.b.h. growth
	Inches					
101	7.6	11.0	3.4	7.9	10.5	2.6
102	7.2	12.5	5.3	7.6	11.4	3.8
103	7.2	12.4	5.2	8.3	12.2	3.9
104	7.8	12.0	4.2	9.2	12.0	2.8

TABLE 6.—DIAMETER DISTRIBUTION OF TREES 10 INCHES D.B.H. AND LARGER ON THINNED AND UNTHINNED PLOTS

D.b.h. class	1914				1949			
	Unthinned	Thinned three times	Thinned twice	Thinned once	Unthinned	Thinned three times	Thinned twice	Thinned once
	Trees per acre							
10	16	10	12	32	54	28	16	32
11	16	4	12	24	36	24	32	24
12	10	4	4	12	16	38	30	30
13	2		2	4	26	28	12	20
14		2	2	4	12	6	22	16
15		2			10	4	6	10
16					6	2	2	12
17	2				4	2	2	4
18					2	4	4	
19						4		
20								
21					2			
22								
23								
Total	46	22	32	76	168	140	126	148

Notes

White Pine Weevil Attacking Red Pine

Until very recently the white pine weevil, *Pissodes strobi* (Peck), has seldom been reported on red pine (*Pinus resinosa*).[1] In fact, as recently as 1950 the senior author expressed the opinion that the insect was not adapted to reproduce itself on that species. This opinion was based on observations over many years that, although red pine might occasionally be attacked, the larvae almost always succumbed before reaching the adult stage.

In 1954, however, one heavily infested plantation was observed on the Ottawa National Forest in which the weevils were completing development, and emerging as adults in large numbers. During the same season in other plantations occasional terminals provided satisfactory breeding places.

During the summer of 1955, a survey was made in 17 easily accessible red pine planations, bordering on roads in the eastern half of the Ottawa National Forest, in order to determine how generally the apparent change of habit prevailed in the locality. Lines were run, crossing the rows of planted trees. The nearest tree on the right of the line in each row was examined provided one was present within 20 feet. An attempt was made to examine 100 trees in each plantation. However, poor survival sometimes made this impracticable. Of the 1,874 trees examined, 1,217 were growing in the open and 657 were under a light canopy, usually aspen. Of these totals, 12 percent of the young trees growing in the open and less than 2 percent under a canopy were attacked by the weevil in 1955, infestation ranging from 0 to 36 percent. In eleven plantations the infestation was less than 5 percent, five between 6 and 15 percent and one 36 percent.

The weevils were successful in almost all the shoots infested, the emerging adults greatly outnumbering their parents. From some shoots more than 50 beetles emerged, a number comparable with rates of emergence from favored hosts such as white pine (*Pinus strobus*), Norway spruce, (*Picea abies*), and Scots pine (*Pinus sylvestris*).

In general the pattern of infestation was similar to that in the favored hosts. The tree heights preferred ranged between four and sixteen feet and infestation dropped to a minimum when the stands became closed. Also the number of emerging weevils was directly proportional to the diameter of the attacked leader.

An attempt was made during the survey of plantations to gain some idea of how severe the weevil attack had been during previous seasons. This proved to be difficult, due to the fragile character of the dead red pine leaders. Not infrequently, they break off before the end of the season of their death, and very few are left intact after a year. This is different from white pine on which the dead leaders may persist for many years. But even allowing for natural pruning of weeviled terminals, the incomplete observations made indicated that the infestation of red pine developed recently.

Evidently the weevil has, within the last few years, become adjusted to red pine, a condition not previously observed. That this change is widespread is indicated by the Michigan forest insect survey for 1955, reporting similar injury in Emmet, Roscommon, and Allegan counties in the Lower Peninsula.

What does this change signify? Has there developed a strain of weevil which prefers red pine or has the insect merely developed the ability to endure conditions to be found in that tree?

In order to throw light on this question tests were made with beetles newly emerged from red and from white pine. An equal number of fresh shoots of white and red pine were placed in wide-mouthed bottles above a layer of moist soil and litter. The bottles were closed with cloth to prevent escape of the weevils. As they emerged the adults were placed in the jars; those from white pine in one and from red pine in another. Every few days the shoots were all removed from the bottles and replaced by fresh shoots. The feeding punctures were counted on the shoots removed from the bottles. The results were surprising. The weevils from red pine and those from white pine fed more frequently on white pine when both pines were equally available. The beetles from both white pine and red pine exhibited a marked preference for white pine as evidenced by the number of feeding punctures. Of the 3,682 feeding punctures cut by weevils that had developed in red pine, only 666 were in the red pine shoots. The weevils reared in white pine exhibited a similar preference. Of 2,004 punctures, 564 were in red pine. Although the weevils reared from red pine showed a greater preference for white pine than did those from white pine, we are not justified in concluding from this single test that there is a real difference in this respect. However, the general preference pattern shows a clear-cut preference for white pine regardless of the host species in which the beetles developed.

In order to learn whether individual beetles exhibit a preference that might have been masked in the mass tests, single beetles were placed in vials containing a single shoot of each pine. Twenty-two beetles were used in this test, twenty-one of which fed on both red and white pine during their period of confinement of from 8 to 60

[1]Mentioned in the Forest Insect Situation in the Lake States in 1953, Misc. Rept. No. 28. U.S.F.S., Lake State Forest Expt. Sta., but was not mentioned in the 1954 report.

hours. The single beetle that failed to feed on both pines was confined for 120 hours and, although it had been reared on white pine it fed only on red.

Judging from the data currently at hand it seems clear that the white pine weevil in parts of Michigan has become adjusted to life on red pine, but when given a free choice it still prefers to feed upon white pine. However, this preference is not sufficiently strong to prevent beetles from feeding on both hosts.

Whether or not this recent adjustment of the white pine weevil to red pine will become general no one can say. If it does, however, vast areas of red pine plantations of a susceptible size would be subject to severe injury. Therefore foresters should be alerted with reference to this potentially dangerous insect.

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Comparison of Lead Arsenate, Methoxychlor, and Benzene Hexachloride for Control of White Pine Weevil[1]

The use of a lead arsenate spray to control the white pine weevil (*Pissodes strobi* Peck) has been described by Potts *et al.*[2] and by Crosby[3, 4]. The spray in concentrated form (four pounds in five gallons of water with suitable sticking and wetting agents) is applied with hand sprayers in the early spring to the terminal buds and leader of each individual stem to be protected. On the basis of several years of experience in five northeastern states Crosby reports that less than one-half percent of the sprayed trees were weeviled the year of treatment, and four years elapsed on the average before reinfestation again attained ten percent. Crosby states further that two treatments should suffice: the first when trees average two to three feet in height, and the second four years later. By the end of another four-year period, a high percentage of the treated trees should have attained a height of sixteen feet or more, free from weevil injury. Further treatment is not practicable with hand equipment.

The following brief report concerns the trial use of two other insecticides, compared with lead arsenate, applied in the manner described above and for the same purpose. In early April, 1952, a three and a half-acre plantation of eastern white pine, located in central Massachusetts, was divided in four nearly equal sections of which three were sprayed with different formulations and one was retained as an untreated control. Plantation trees ranged in height from eight to twelve feet. Naturally established pines, mostly somewhat shorter than those planted, were liberally distributed through the stand. Some red pine was present also. Full stocking prevailed everywhere, and crowns were beginning to close. The treated area is bordered in part by mature pine, and in part by abandoned fields and land recently cut over which support considerable numbers of seedling and sapling-size pines. At the time of treatment many individuals, both on and around the treated area, had been injured previously by weevil attack. Old-field stands of susceptible age in the general neighborhood were heavily infested.

Three materials were applied in the 1952 tests: benzene hexachloride, ten percent active gamma isomer (trade name Lexone 10-GW), and methoxychlor, fifty percent wettable powder (trade name Marlate 50), and lead arsenate (Nurex form), mixed at the rate of one, two, and four pounds respectively, in five gallons of water.

In 1953, the control area of 1952, untreated at that time, was sprayed with methoxychlor at one-half the concentration employed in the 1952 program. The three plots initially sprayed in 1952 received no treatment in 1953.

A tally of weeviled trees was taken in late summer for each of the years 1952 to 1954. The degree of control achieved by the several treatments is indicated in Table 1.

In conclusion, it would appear that either methoxychlor or benzene hexachloride is at least the equal of lead arsenate as a spray treatment for control of white pine weevil. The lighter dosage of methoxychlor gave somewhat less effective control than the heavier dosage, but the difference was not great, and the data are probably too limited to permit sound conclusions in this respect. Treatment with any of these materials is a marked improvement over no treatment. The results obtained in the

TABLE 1.—COMPARATIVE CONTROL OF THE WHITE PINE WEEVIL EFFECTED BY BENZENE HEXACHLORIDE, METHOXYCHLOR, AND LEAD ARSENATE APPLIED AS A SPRAY TO TERMINAL BUDS AND LEADER

Plot	No. Trees	Treatment 1952	Treatment 1953	Concentration per 5 gal.	No. Trees Infested 1952	1953	1954	Percent Infested 1952	1953	1954
A	544	Benzene hexachloride	None	1 lb.	2	12	32	0.4	2.2	5.9
B	894	Methoxychlor	None	2 lbs.	0	25	30	0.0	2.8	3.3
C	806	Lead arsenate	None	4 lbs.	4	61	50	0.5	7.6	6.2
D	805	None	Methoxychlor	1 lb.	113	7	25	14.0	0.9	3.1

[1]Contribution No. 1015 of the University of Massachusetts Agric. Expt. Sta.

[2]Potts, S. F., A. C. Cline, and H. L. McIntyre. The white pine weevil and its control by the application of concentrated spray. Jour. Forestry 40: 405-410. 1942.

[3]Crosby, David. Concentrated lead arsenate spray for control of white pine weevil. Jour. Forestry 48: 334-336. 1950.

[4]Crosby, David. How to control the white pine weevil with a hand sprayer. U.S.D.A. Northeastern Forest Expt. Sta., Forest Res. Note 30. 1954.

above trials are less satisfactory than might be anticipated under practical circumstances because one-quarter of the area was left untreated initially, and the total area treated was small relative to the surrounding sources of reinfestation. Complete treatment of a larger area should produce even more effective control.

It should be noted that neither methoxychlor nor benzene hexachloride, unlike lead arsenate, leaves any readily detectable deposit on the sprayed surface, and this fact makes more difficult the separation of treated from untreated individuals. Presumably this situation can be corrected by the addition of coloring or white-washing materials to the spray mixture. Benzene hexachloride is a disagreeable material with which to work, and the men applying the sprays were outspoken in their objection to it. No such criticism was raised concerning methoxychlor.

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Plastic Tubes for Controlled Pollination of Pine

Small plastic tubes, similar to those for packaging toothbrushes, have been successfully used in pine tree breeding at Crossett, Arkansas. The tubes have a slightly higher initial cost than most other bagging materials, but they can be used for years and are therefore very economical. Their special advantages are their lightness, which enables them to ride well in the wind, and their stiffness, which protects the flowers. Conventional bagging materials all have some tendency to collapse on the branch and injure the flowers.

The cylinders are made of a clear, stiff, thermoplastic known as cellulose acetate butyrate. All are open on one end. Lengths vary from 6 to 12 inches, and diameters range from one-half to two inches. Special sizes can be secured. The smaller sizes are furnished either with or without air vents in the closed end. All large sizes have removable caps.

FIG. 1.—Pollinating a loblolly pine flower in a plastic tube.

These features adapt the tubes to several kinds of pollination techniques. They are especially suitable for use with a hypodermic syringe and needle (Fig. 1). The needle is inserted through the vent in the outer end and directed at the flowers. A puff of pollen is released by squeezing the bulb. The tubes that are supplied with caps are also well adapted for brush pollination, for the cap can be removed and the brush inserted and applied directly to the flowers.

At Crossett, a cloth sleeve four to six inches square was cemented and taped to the open end of each cylinder to provide a simple means of attaching it to the branch. For critical work the cloth sleeve should be of heavy, pollen-proof material. For most tree-breeding purposes inexpensive cotton cloth is probably satisfactory. Field tests with vaseline-coated slides showed that pollen did not get through ordinary cloth and up into the tubes, but air and moisture readily passed in and out.

In fitting the tube over the flower-bearing shoot, it is first necessary to strip off the needles to a point several inches below where new growth begins. The tube can then be slipped on and fastened to the old wood by tying the sleeve firmly around the branch with a commercial plant tie. The vent hole in the outer end of the smaller tubes should be covered with tape to keep out stray pollen.

The size of tube needed depends on the tree species and the number of flowers on each shoot. The critical factors are the amount of elongation of the developing shoot during the breeding season, and the amount of space required by the newly opened female flowers as they expand. The first factor determines cylinder length and the second the diameter.

For tree breeding at Crossett, tubes 6 to 12 inches long were found most useful, although very vigorous loblolly pine leaders required somewhat longer ones. Short tubes are generally very satisfactory for longleaf and shortleaf pines, which do not elongate much during the breeding season. Longleaf pine requires cylinders up to 1½ inches in diameter. This size should also be used on loblolly and slash pines if there are more than two flowers on a flower-bearing shoot. For single flowers, tubes 1 inch in diameter are adequate.

Tubes can be placed as soon as the female flowers are evident. The usual practice is to begin placing them seven to ten days before the female flowers are mature. They are removed after all danger from contamination by stray pollen is past, usually about one week after pollination.

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Reviews

Forestry and Related Research in North America

By Frank H. Kaufert and William H. Cummings. 280 pp. Society of American Foresters, Washington 6, D. C. 1955. $5.

This book is the report on the Forestry Research Proect of the Society of American Foresters, undertaken in 1953 to review forestry research during the past 25 years, determine its current status, and formulate recommendations and goals for the next quarter century.

Part I, "Forestry and Related Research in the United States," opens with general recommendations and goals, followed by several sections supporting the recommendations, and by a summary of research during 1928-1953. The longest portion consists of 15 subject matter reports dealing with accomplishments and costs, personnel and training, and recommended expansion of research within each field. These reports, informative and well organized, provide much of the background for the general recommendations, and are an invaluable summary of research in the several fields for the 25 years.

The authors' goal of $200,000,000 for forestry and related research in 1978 is reasonable in light of the $45,400,000 expended in 1953. It is based on the increasing complexity of the research fields, the importance of the forest products industries to the national economy, and the fact that in 1953 relatively much less was spent on forestry research than on research for industries competitive with wood.

Throughout the book one finds gratifying insistence upon the need for adequate salaries and specialized graduate training for research personnel. There is also timely expression of the need for fellowships sufficiently liberal to permit recipients to meet their personal obligations while devoting full time to study.

Despite its general high level, Part I contains some debatable elements. The relegation of forest wildlife, range, watershed management, and recreation into a separate category called forestry-related management research is unrealistic and gives a false impression. These subjects are not merely related to forest management; they are part of it.

In the classification into four groups of agencies conducting research — federal, accredited forestry schools, other public and school groups, and industry and private—the second is not particularly meaningful as the schools are accredited on the basis of educational rather than research qualifications. The other public and school group is an aggregation of administrative and educational agencies so diverse that their only common attribute appears to be exclusion from the other groups.

The authors' proposed allocation of funds to the four agency groups could lead to inter-agency dissension and divert attention from the research program as a whole. Why not merely propose the $200,000,000 goal in toto, with a strong recommendation for inter-agency coordination?

The discussion of research *per se* is disappointing. The facetious definition of research quoted in the text fails to express the high level of disciplined endeavor necessary to the solution of forestry's complex problems. The book would have been strengthened by an analysis of forestry research comparable to that in Bailey's and Spoehr's *The Role of Research in the Development of Forestry in North America.*

Part II, "Forestry and Related Research in Canada," prepared by Samuel T. Dana, dean emeritus, School of Natural Resources, University of Michigan, gives a concise, clear account of research as conducted by federal and provincial governments, forestry schools, and industry which will be of particular value to foresters in the United States interested in a research program closely paralleling our own as to problems and species. We can ponder to our advantage the section describing cooperation in research.

Part III, "Forestry and Related Research in Mexico," was prepared by Enrique Beltran, director, Instituto Mexicano de Recursos Naturales Renovables, A.C., Mexico, and translated and edited by Dr. Tom Gill, executive director, Charles Lathrop Pack Forestry Foundation. The report presents thoughtful recommendations for fundamental and empirical research and attendant training, financing, and integration with research in other natural resource fields. There follows a very well annotated review of the literature on Mexican forestry research.

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Theodore Roosevelt's America

Edited by Farida A. Wiley. 418 pp. Illus. Devin-Adair Company, New York, N. Y. 1955. $5.75.

This book by and about Theodore Roosevelt is one of the publisher's American Naturalists Series. *John Burrough's America* and *Ernest Thompson Seton's America* precede it. *William Bartram's* and *Washington Irving's Americas* are in preparation.

This also is a Roosevelt *reader* for people who would enjoy in one volume the essence of Roosevelt's American adventures and nature writings. Miss Wiley has chosen excerpts chiefly from *Hunting Trips of a Ranchman, Ranch Life and the Hunting Trail, The Wilderness Hunter,* and *Through the Brazilian Wilderness.*

She richly samples Roosevelt's writings: *Action*— ". . . the great bear turned with a harsh roar of fury and challenge, blowing the bloody foam from his mouth . . . then he charged straight at me . . . so that it was hard to aim." *Conservation*—"Overstocking is the great danger threatening the stock-raising industry on the plains." *Contention*—" . . . in the chase of the white-tail . . . stealth and caution are the prime requisites . . . Hunting the blacktail . . . is the nobler sport." *Description*—

"When the days have dwindled, and the nights seem never-ending, then all the great northern plains are . . . an abode of iron desolation . . . furious gales blow out of the north, driving before them . . . blinding snow dust, wrapping the mantle of death around every unsheltered being that faces their unshackled anger. They roar in thunderous bass as they sweep across the prairie . . . they shiver the great brittle cottonwoods, and beneath their rough touch the . . . pines . . . in the gorges sing like the chords of an Aeolian harp." *Regret*—". . . one of those occasions when there are two courses to pursue, neither very good, and . . . one is apt to regret whichever decision is made." *Sheep*—". . . bleating idiots . . . No man can associate with sheep and retain his self-respect." *Tenderness*—"Each was longing for the homely things . . . dear to him, for the home people . . . dearer still, and for the one who was dearest of all."

The book includes most of Roosevelt's memorable, quotable definitions of hunting as primarily rich understanding of nature and vigorous self-reliance, his disinterest in large bags, and his idealistic concepts of manly fortitude. Numbers and distribution of wildlife in the frontier west give understanding helpful to those who conserve today's wildlife and cautioning to those who flaunt it as tourist bait.

John Burroughs, Gifford Pinchot, Henry Fairfield Osborn, and Ethel Roosevelt Derby help preface the book. Excerpts from Leo Miller's *The Roosevelt Expedition in South America* and various lectures and essays by Roosevelt enrich it. These other writers attest Roosevelt's knowledge as a naturalist, but readers discover in Roosevelt's own references to events, observations, paced distances, and shots fired, the definiteness characterizing the reliable ecologist. He harbored few assumptions of his times; erring markedly only in reported ranges of white goats and tamaracks.

A chronology of important events in the life of Theodore Roosevelt serves those who will relate his accomplishments to events of his day and ours. A detailed index guides the reader to desired topics. A four-page source of quotes lists unabridged material from which this volume is condensed.

Illustrations are an intimate, revealing photograph of Roosevelt and silhouettes by Ugo Mochi, charming, but decorating more than delineating.

A few errors may annoy the exacting; the date of 1889, rather than 1883, for Roosevelt's principal bison hunting, the establishment of Yale School of Forestry listed as 1904 instead of 1900, and two incorrect citations of chapter sources. With corrections or a publisher's list of errata to give the book its legitimate utility as a reference, most readers will treasure it.

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The Law of Forestry

By W. A. Gordon. Her Majesty's Stationery Office, London. 1955. £3 10s.

This book of nearly 600 pages covers a field in which it has no competitors. The author is especially qualified for the presentation of his subject since he not only was educated as a forester and as a barrister, but has also had two decades of experience in practical forest administration. The discussion is confined to Great Britain and the British colonies. However, the principles of law expounded in the book are generally applicable to any area in which the Anglo-Saxon system of law prevails.

The first 132 pages are directed principally to a discussion of the different estates and interests that may be enjoyed in forest land or in forest products with pertinent citations to acts of Parliament and court decisions which form the basis for statements by the author as to the law. Within these pages the author has condensed the substance of the thousands of pages in treatises on real and personal property that a forester or a layman would need to read to acquire a general view of the law. Nearly all these pages may be read with interest and profit by any American forester. While the common law has been supplemented and modified in various ways by statute law in Great Britain and in the different American states, the fundamental conceptions still prevail and precedents established in Great Britain are generally respected in America.

The reader will be impressed by the fact that the idea of forest conservation has apparently been much more vigorously promoted in America than in Great Britain. Not until after the First World War did the need for a campaign of forest conservation arise in Great Britain and even then no vast area of undeveloped land was available for forest production as in the United States and the British colonies.

In chapters 34 to 38 Gordon presents an illuminative exposition of the British governmental activities between 1918 and 1952 that were directed toward the increasing of forest resources in the British Isles. The extensive authority vested in the Forestry Commission under the Act of August 19, 1919 and the effort that was made to insure a nonpartisan administration of the act is fully explained. The Acts of 1923, 1927, 1945, 1947, and 1951 are carefully analyzed and the pertinence of particular provisions explained.

By the Act of 1945 the Forestry Commissioners were made sub-

Forestry Dictionary

We have been notified by the Swedish Forestry Association that they have just published a second revised edition of the Swedish-English-German-French Forestry Dictionary by M. E. Simonen (reviewed in JOURNAL OF FORESTRY, May, 1955). The dictionary which has been sold out since May can again be ordered from Svenska Skogsvårdsföreningen, Regeringsgatan 18, Stockholm C, Sweden. Price $6.80.

ordinate to the Minister for Agriculture and Fisheries in England and Wales and to the Secretary of State in Scotland, but apparently the influence of the Commissioners has not been diminished by this arrangement. The Act of 1951 gave the Commissioners increased authority over the management of forests on privately owned land subject to certain limitations by an Advisory Committee. This act provided for rather strict beaucratic control over forest lands.

Taxation, subsidies, nuisances, forest fires, game management, theft, trespass, conversion, and malicious damage to forest property are succinctly treated. About one-third of the book is devoted to forest administration in the British colonies, including a general discussion of forest law in the colonies and detailed observations upon forest conditions and legal provisions in the separate colonies.

Many American foresters would not be interested in much of the detailed information in the appendix. However, even these pages constitute a part of the history of forest conservation, not elsewhere readily available.

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Publications of Interest

A pamphlet, *Deer and Aspen*, illustrated in color, has been published by American Box Board Company, Filer City, Michigan, to encourage multiple use of forest lands by showing how wise management may contribute materially to the welfare of the deer herd. The information on which this publication is based came from a study recently completed by the University of Michigan in cooperation with industry and the several state and federal agencies in Michigan.

The pamphlet shows clearly by words and colored pictures the story of deer in Michigan, their quantitative food requirements, the problem of over-population, and what can be done to help the deer herd and at the same time provide raw materials for the industries dependent upon a continuing supply of aspen.

* * *

The *International Journal of Agrarian Affairs*, Vol. II, No. 2, June, 1955, is devoted to the question "Agriculture and Forestry: Competition or Coexistence?" While containing no startlingly new information, the publication does present an interesting comparison of conceptions and developments relative to such competition in Costa Rica, France, Germany, Great Britain, Greece, India, Norway, the United States, and Sweden. Price 5s. Od. (80c) net, Oxford University Press, New York and London.

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Tree Planters' Notes No. 21, U. S. Dept. Agric., Forest Service, Washington 25, D. C., contains 10 articles dealing with nursery soil problems and seed. *No. 22*, Seed Dealers' List, 1955, is a directory of some commercial dealers in seed and planting stock for some common trees and shrubs. Listing is cross-indexed by species name.

Tax Tips for Timber Owners

Small timber owners may find the 1955 edition of an 8-page pamphlet of the Forest Service helpful in computing their federal income tax. The revised pamphlet, *Federal Income Tax Tips for the Small Timber Owner*, contains the 1955 capital gains schedule, and references in the text have been changed accordingly. A number of other changes, for the most part relatively minor, have also been made.

Author Ellis T. Williams points out that many small timber owners may pay a larger federal income tax on their woods operations than the law requires. Some do not deduct an allowance for depletion representing their investment in the timber harvested. Others do not realize that reporting receipts from sales of timber as capital gain rather than as ordinary income may substantially reduce their tax.

The pamphlet explains through examples how to treat receipts as ordinary income and as capital gain. It tells how to figure depletion allowances, discusses the possibility of deducting for losses of timber from fire, windstorm, or other casualties, and what costs of ownership and operation are deductible.

A copy of the pamphlet may be obtained from the Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*
Range Management Section Compiled by FRANCIS FLICK, *Library, U. S. Department of Agriculture*

General

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Reproduction and Establishment of Velvet Mesquite as Related to Invasion of Semidesert Grasslands. By G. E. Glendening and H. A. Paulsen. 50 pp. Illus. Supt. of Documents, U. S. Govt. Print. Off., Washington 25, D. C. U. S. Dept. Agric. Tech. Bul. No. 1127. Oct. 1955. 25 cents.

The Wheel-Point Method of Survey and Measurement of Semi-Open Grasslands and Karoo Vegetation in South Africa. By C. E. M. Tidmarsh and C. M. Havenga. 49 pp. Illus. Govt. Printer, Pretoria. Union of South Africa Dept. of Agric., Botanical Survey Memoir 29. 1955. $1.35.

Silviculture

Early Developments in a Subalpine Lodgepole Pine Stand of Fire Origin. By K. W. Horton. 6 pp. Canada Forestry Branch, Ottawa. 1955. Tech. Note No. 16.

Effect of Watering, Shading, Seed Bed Medium, and Depth of Sowing on Red Pine Germination. By J. W. Fraser and J. L. Farrar. 3 pp. Canada Forestry Branch, Ottawa. 1955. Tech. Note No. 15.

Eucalypts for Planting. 403 pp. Illus. UN FAO, Rome, Italy. 1955. Forestry & For. Prod. Studies No. 11.

Shade Tree Pruning. By A. R. Thompson. 25 pp. Illus. U. S. National Park Serv., Washington 25, D. C rev. 1955. Tree Pres. Bul. No. 4, 15 cents (Govt. print. off.)

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Experimental Trials of Wildlife Food and Cover Plants. By T. S. Baskett. 24 pp. Illus. Univ. of Missouri Agric. Expt. Sta., Columbia. 1955. Research Bul. No. 584.

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Comparison of Methods of Estimating Summerwood Percentage in Wide-Ringed, Second Growth Douglas-Fir. By Diana Smith. 8 pp. Illus. U. S. Forest Products Lab., Madison 5, Wis. 1955. Rept. No. 2035. Mimeog.

Tension Wood in Eastern Cottonwood. By Margaret Kaeiser and M. Y. Pillow. 9 pp. Central States Forest Expt. Sta., Columbus, Ohio. 1955. Tech. Paper No. 149.

Society Affairs

Officers and Council
1956-1957

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729 N.E. Oregon St.
Portland 8, Ore.

HENRY J. VAUX
School of Forestry
University of California
Berkeley 4, Calif.

SCHOOL BOX SCORE
1956 MEMBERSHIP

School	Student applications received: Feb. 1956	Total 1955	Total 1956
Alabama Polytechnic Institute	0	18	0
University of California	3	17	28
Colorado A & M College	2	9	13
Duke University	1	3	2
University of Florida	3	17	3
University of Georgia	0	28	0
University of Idaho	1	4	8
Iowa State College	4	22	5
Louisiana Polytechnic Institute	12	13	12
Louisiana State University	1	43	9
University of Maine	7	12	7
University of Massachusetts	0	11	9
Michigan State University	0	14	6
University of Michigan	4	21	12
University of Minnesota	8	19	10
University of Missouri	0	26	0
Montana State University	2	25	12
State University of New York	7	23	32
North Carolina State College	1	22	1
Oregon State College	2	38	5
Pennsylvania State University	0	32	0
Purdue University	1	24	14
Utah State Agricultural College	6	12	6
University of Washington	0	28	5
West Virginia University	1	26	1
Yale University	5	16	5
Totals	71	523	205

SECTION BOX SCORE
1956 MEMBERSHIP

Section	Applications received[1]: Feb. 1956	Total 1955	Total 1956
Allegheny	1	63	1
Appalachian	4	38	7
Central Rocky Mountain	2	12	13
Central States	1	44	15
Columbia River	6	100	10
Gulf States	16	107	27
Inland Empire	4	10	11
Intermountain	7	18	8
Kentucky-Tennessee	1	9	2
New England	12	50	24
New York	7	33	32
Northern California	5	33	31
Northern Rocky Mountain	6	44	16
Ozark	2	47	3
Puget Sound	5	65	14
Southeastern	7	85	12
Southern California	0	3	0
Southwestern	0	12	0
Upper-Mississippi Valley	14	51	17
Washington	0	2	0
Wisconsin-Michigan	8	40	27
Totals	108	866	270

[1]Student, Junior, Affiliate, Associate (Initial) grades only.

The President's Column

DEWITT NELSON

The comment most commonly made by the many members with whom I have talked these past few weeks is this, "How can the JOURNAL OF FORESTRY be made a more popular and useful magazine?" I presume every new president has received similar comments. In response I have asked, "What do you suggest?" So far most of the recommendations have been rather nebulous. Therefore I have tried to analyze the JOURNAL to ascertain whether or not there is valid cause for criticism. I know that the Council, the editorial staff and associate editors welcome your comments and your suggestions. They also welcome your contributions. We all have a common interest and a common objective in wanting the JOURNAL to serve as a medium for presentation and exchange of professional information in an interesting and stimulating manner.

We must remember that this is a professional journal and represents the diversification of interests which characterizes our profession. Its primary objectives are to set standards for professional achievement, to inform, to inspire appreciation of the work of our fellow foresters, and to stimulate interest in the important field of our Society affairs. The recent change in format and the addition of advertising accomplished two things: first, a more attractive, interesting, and useful magazine; and second, a major help in publication financing.

The introduction of *Forest Science* in 1955 as a quarterly journal of research and technical progress has relieved the JOURNAL OF FORESTRY of a large backlog of valuable articles so that now contributions can be published more currently. *Forest Science* will also publish longer technical papers than could possibly be presented in the JOURNAL.

Let us take a look at the contents of the JOURNAL which we receive each month. A review of the table of contents for Volume 53, 1955, published in the December issue shows 105 articles (average 9 per month) covering some phase of almost every forest function and problem. True, there are some in which you or I may not be interested but someone else may be vitally so. We don't read every article in the popular magazines but we profit from those which we do read.

For even the most casual reader and for current information I am sure no one overlooks the last half of the JOURNAL. Here we find "Notes" where new and current reports are made available; "Points of View," where we can take issue with our fellow-foresters and where ideas and suggestions for the JOURNAL are received; "Reviews," an interesting and valuable book review section from which one can receive guidance for his professional reading and library acquisitions; "Current Literature," which features new publications on forestry and allied interests; "Society Affairs," which keeps us up to date on what is going on throughout the Society. Here we learn what other Sections and Chapters are doing and here we can get ideas for our own use; here we keep up with the ever-growing membership, Society finances, projects and programs, and here too, the president endeavors to stimulate thinking in his monthly column; "Forestry News," an excellent spot for current events of all kinds; and last the very important "Index to Advertisers." I know from experience that this index can be a valuable asset. Its use and reference to the JOURNAL as the source of information on the product can be of great help to Lloyd Thorpe in securing more advertising.

Now that we have reviewed the JOURNAL'S contents, what do we find there? To me it points up opportunities for each of us to contribute to its contents and thereby create and build the type of publication we want. More than 300 professional foresters contributed to the JOURNAL during 1955. This certainly indicates its broad interest value and scope of coverage. There is a place for your contributions and a need for your thinking. As in everything else in which we participate the JOURNAL will reflect our interests and our desires only so far as we put thought and effort into it. In other words, only foresters can make the JOURNAL OF FORESTRY great.

We invite your articles, your suggestions, your reviews, and the news of your local current events.

DeWitt Nelson

Council Meeting Called

President DeWitt Nelson has called a meeting of the S.A.F. Council to be held in New Orleans, La., February 20-21.

Members of the Society who desire to suggest any matters of business for the Council's consideration are invited to submit them in writing to the executive secretary not later than February 15.

Northern California Section Holds Winter Meeting

How are we doing, and where are we going in getting forestry applied on the ground? This was the question the Northern California Section, Society of American Foresters, asked itself at its annual winter meeting in San Francisco, December 3, 1955.

For the answers, some 200 members attending turned to speakers from a cross section of the profession in California, to Dean Henry J. Vaux of the University of California School of Forestry, and to William S. Rosecrans, chairman of the State Board of Forestry.

Both management and service activities were represented in the analysis of how well foresters are meeting their professional challenge in the state. Land managers were represented by Hal Bowman, Sam H. Bryan, Robert E. Dasmann, and Henry Trobitz. Those who provide services through consultation or education were represented by James Denny, William Hendrickson, and Myron S. Wall.

Dean Vaux summarized the proceedings by pointing out four "dominant themes" in what the speakers had to say. First, a most important part of the forester's job is working with people—from high school students to loggers and boards of directors. Second, foresters are increasingly operating in an economic fromework. Third, foresters need more technical information through expanded research and use of more channels of communication. Fourth, foresters need new tools outside the technical field—better economic appraisals of management alternatives and greater public relations efforts, for example.

As to how well foresters are meeting their challenge, Dean Vaux said that a new yardstick is needed. We can no longer judge ourselves merely by how well we balance cut and growth and protect markets for wood, he said, because the Timber Resource Review

and the Stanford Research Institute's study have shown that cut and growth are being brought into balance and there is a potentiality for expanding wood markets. Today's criterion of success, Dean Vaux declared, must be of broader gauge. We must judge ourselves by how nearly the forest lands contribute their maximum to an expanding economy.

Mr. Rosecrans also called for a broad-gauge view of the profession in his banquet speech. Reminding the banquet goers of the tremendous pressure on wild lands that is caused by the state's growth, he said that foresters are going to need more than their "bag of technical tricks" in the future. To take the same place among industrial and civic leaders as other professional men, Mr. Rosecrans said, foresters must increasingly educate themselves in economics, history, English, and general cultural subjects.

As though in response to these diverse pleas, the convention voted to form three new committees on professional problems. One, with George Craig as chairman, will work with educators and Society subsections to encourage more outstanding high school students to make a career of forestry. Another, with Myron S. Wall as chairman, will study the advisability of professional licenses for foresters. The third, with Harry Abraham as chairman, will study the need for additional subsections in California.

Nominees for new officers named at the convention were: For chairman—Donald E. Knowlton and Leon Thomas; for vice chairman—Myron Wall and Willis C. Branch; for treasurer—Earl Seehrist and William A. Welder.

CLYDE M. WALKER
Editor,
Northern California Section

Southern California Section Holds Meeting

The winter meeting of the Southern California Section was held December 2, 1955, at the Green Hotel, Pasadena. Chairman Carl C. Wilson presided, calling the meeting to order at 2 P. M.

Chairman Wilson and Ralph Van Wagner gave a report on the national meeting held in Portland, Ore., in October, after which the chairman introduced the program for the afternoon session.

Chief Keith Klinger, Los Angeles County forester and fire warden, showed a film report on "Operation Fire Stop." The film together with Chief Klinger's narration gave a vivid description of the work accomplished at Camp Pendleton in 1954.

Mr. Dave Rogers of the Big Bear Timber Company, gave an excellent report on his company's operations. They are removing the dead and high risk timber from Southern California's forested recreation areas, as well as salvaging timber from some of our recent burns. Rogers reported approximately 7,000,000 board feet were salvaged from the Fish Fork fire area of 1953. Several million board feet have been cut on the Big Pines recreation area of the Angeles National Forest and several million more from the Barton Flatts area of the San Bernardino National Forest. These operations have greatly enhanced the beauty of the recreation areas by removing the large numbers of snags and high risk trees which have developed in the last few years.

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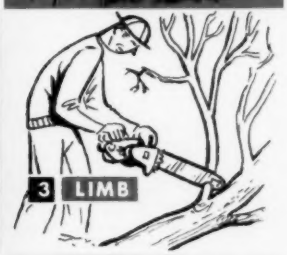

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Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

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Positions Wanted

Forester, 26, B.S. 1951; married; veteran; presently employed with state agency. Desires relocation with private industry offering opportunity for advancement, preferably in the south or southeast. Experience: 3 years formulating and carrying out forest management plans on private estates.
Box A, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, M. S. Forestry, M. S. Tropical Forestry, Ph.D. Silviculture, Univ. Washington 1954; Dutch, married. Experience 2½ years teaching, 2½ years research, one year practice in management, inventory, mensuration. Desires teaching-research position with educational institution. Tropical experience, specialization silviculture, tropical silviculture, management, ecology, phytosociology, botany, pedology, entomology. Entry permit as non-quota immigrant immediately when position offered. American sponsors available.
Box C, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, 29, B.S.F. graduate of Lake State college, 1951. Married, one child. Presently plant manager of hardwood veneer mill. Experience: one year plant management, one year general accounting, two years forestry with state agency specializing in photo interpretation and forest inventory. Experienced log buyer and cruiser. Desires position involving administration, management, and field work offering opportunity for advancement.
Box D, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, forest production, 1951, B.S.; veteran, 33, married, 2 children. Six years small logging operations, Michigan; three and one-half years, Navy; two years forest product inspector for national firm; knowledge of wood preservation and preservative analysis; two years wood utilization. Presently with U. S. Forest Service doing civil engineering work, road location, and related work. Prefer Lake States but would consider elsewhere.
Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

Mr. Carl Gerhardy of the Los Angeles County Parks and Recreation Department presented a brief review of proposed "Mountain Recreation Program" for Los Angeles County and Mr. Paul Bauman of the Los Angeles County Flood Control District showed a series of slides on flood control work in Switzerland.

The meeting was adjourned at 5 P. M. by Chairman Wilson until the dinner session.

Following the dinner, Col. Harold Hedger, chief engineer for the Los Angeles County Flood Control District, showed a film and gave a very interesting talk on the flood control program and the work being done to alleviate the many problems in Los Angeles County in that connection.

Assistant Secretary of Agriculture Peterson, Regional Forester Connaughton, and Assistant Regional Forester George James were distinguished dinner guests.

There being no further business, the meeting was adjourned at 10:00 P.M.

LYNN R. BIDDISON
Secretary-Treasurer

Kentucky-Tennessee Section Holds Annual Meeting

The Kentucky-Tennessee Section of the Society of American Foresters, held its annual meeting December 2-3, 1955, at Mammoth Cave National Park, Kentucky. Harry Nadler, of the Kentucky Division of Forestry served as program chairman. Seventy-eight members attended.

New officers for the coming year are:

Chairman, John W. Lehman, Norris, Tennessee, with TVA.

Vice Chairman, Robert F. Collins, U. S. Forest Service, Winchester, Ky.

Secretary-treasurer, Russell Stadelman, Nickey Brothers, Inc., Memphis, Tenn.

In addition to covering Section activities, a discussion was held on the matter of the Kentucky-Tennessee Section serving as hosts for the annual meeting of the Society in Memphis, October 14-17, 1956.

Philip Briegleb, director, Southern Forest Experiment Station, New Orleans, represented President E. L. Demmon, and met with other members of the Program Committee for the 1956 annual meeting, of which he is chairman.

At the annual dinner on the night of December 2, awards were presented to outstanding laymen who had contributed to forestry in Kentucky and Tennessee. Recipients of these awards were: for Tennessee,, the Polk County Chapter of Keep Tennessee Green Association, which was represented by F. R. Bradford, Benton, Tennessee; for Kentucky, Mr. Wm. C. Johnstone of the Kentucky Bankers Association, Louisville, Kentucky.

Mr. C. D. Dosker, Gamble Bros., was toastmaster at the annual dinner, and introduced Mr. Henry Ward, director of the Kentucky Department of Conservation, who was the principal speaker.

RUSSELL STADELMAN
Secretary-Treasurer

H. G. Wilm Appointed to Governing Board of Agricultural Research Institute

At the October meeting of the Agricultural Research Institute in Washington, H. G. Wilm was appointed as a member of the Governing Board, replacing E. L. Demmon. Dr. Wilm, who now represents the Society of American Foresters in the Agricultural Research Institute as well as in the Divi-

Forester, B.S.F. and M.S. 35, married, 3½ years army service. Over 10 years experience in private industry, forest research, and forestry teaching. Currently employed in lumber industry but desires relocation with greater opportunity for professional service and advancement.
Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F. 1950, married, desires forest management position in Western States. Five years experience forest management in Pacific Northwest; cruising, mapping, reproduction surveys, road location, fire detection and suppression. Experienced in photogrammetric methods, use of surveying instruments, etc.
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sion of Biology and Agriculture of the National Academy of Sciences, reports that their annual Washington meeting was very interesting indeed. Several of the formal papers were outstanding. Especially noteworthy was the address given by Assistant Secretary Irvin L. Peterson of the U. S. Department of Agriculture.

University Forestry Department,
Unioninkatu 40 B
Helsinki, Finland
November 1, 1955

Mr. Henry Clepper
Society of American Foresters
Dear Mr. Clepper:

After having returned recently from Sweden from a course of lectures I found on my desk your letter informing me of my election as an Honorary Member of the Society of American Foresters.

This is an honor I highly appreciate although I feel I have not earned it.

Since my first visit in your country in 1933 I have admired the rapid and successful progress of the U. S. A. in practical forestry, in forest research work and in forest education. Therefore it gives me a great pleasure to be able nowadays to send, almost every year, at least one or sometimes more of my former pupils to study in your famous schools of forestry and get acquainted with forestry conditions in the U.S.A.

During the last years I have also been happy that some of your young foresters have come to our school of forestry as Fulbright students. I feel that in trying to help these young men of both countries I can perhaps be helpful toward mutual understanding and friendly cooperation between American and Finnish foresters.

The excellent work the Society of American Foresters has accomplished in the promotion of forestry in America gives my membership a high value in my estimation. I want to send my warmest thanks to the Society.

I also want to thank the Society sincerely for the Journal of Forestry so well known among our foresters. Now each number of it will be for me a dear reminder of the esteemed colleagues and good friends on the other side of the Ocean.

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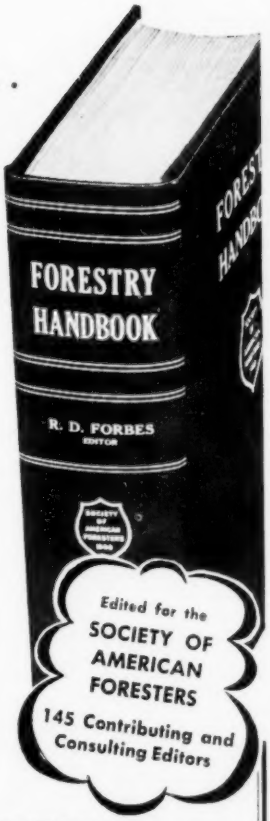

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Members Named to Michigan Registration Board

The newly appointed 5-member Michigan State Board of Registration for Foresters held its initial meeting on December 15th in East Lansing. Members of the board are: Kenneth P. Davis, Ann Arbor, chairman, Department of Forestry, School of Natural Resources, University of Michigan; Eugene R. Kuhne, Hart, head, Forestry Associates, Inc.; U. J. Noblet, Houghton, head, Forestry Department, Michigan College of Mining and Technology; Robert E. Schmeling, Escanaba, woodlands manager, Escanaba Paper Co.; and Terril D. Stevens, East Lansing, head, Forestry Department, Michigan State University.

Officers elected at the meeting were as follows: chairman, R. E. Schmeling; vice chairman, K. P. Davis; and secretary, E. R. Kuhne.

Plans were made by the Board to have necessary records, application forms, and related material prepared by early February. It was indicated that a subsequent announcement would be made as to time and place application forms would be available for those wishing to apply for registration under the Act. (Passage of this law was reported in the August, 1955, issue of the JOURNAL.)

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J. D. Gilmour (1886-1955)

John Douglas Gilmour, 69, of Montreal, Canada, died suddenly on December 21, 1955.

Born September 22, 1886 at Doe Lake, Ontario, he attended Ontario Agricultural College receiving the degree bachelor of science in agriculture, and the University of Toronto where he received a bachelor of science degree in forestry in 1911.

His forestry experience was extensive. At various periods he was a timber cruiser for the Canadian Pacific Railway, district forester with the British Columbia Forest Service, and for nearly 30 years was chief forester for pulp and paper companies in Newfoundland and Quebec. During the war he was a consultant to the Royal Canadian Air Force, later chief forester for H. R. MacMillan Export Company, Ltd., and in recent years engaged in consulting work, specializing in problems of forest management, economics, and taxation.

For two years he was chairman of the Woodlands Section of the Canadian Pulp and Paper Association, and served on the advisory committee of the National Research Council of Canada. He was active in the Canadian Institute of Forestry as well as the Society of American Foresters.

William R. Kreutzer (1877-1956)

William R. Kreutzer, 78, of Fort Collins, Colo. died January 2.

He is believed to have been the first U. S. forest ranger, having been appointed in Denver on August 8, 1898 by Col. W. T. S. May, superintendent of forests for Colorado and Utah, then in the Department of the Interior.

Born on a Colorado cattle ranch on October 3, 1877, Kreutzer was a young cowboy not yet 21 when he got the job of forest ranger at a monthly salary of $50, he had to feed and clothe himself and furnish his own horses. He was in sole charge of 300,000 acres of Rocky Mountain timberland.

Appointed supervisor of the Gunnison National Forest in 1907, he subsequently in 1921 became supervisor of the Roosevelt at Fort Collins, and retired from the Forest Service in 1939 after 41 years as a forest officer.

During his colorful career, Mr. Kreutzer participated as a peace maker and government official in the bitter range wars between cattlemen and sheepmen following the passing of the free range. These events were told in detail in a biographical sketch published in the JOURNAL OF FORESTRY for October 1947.

F. J. Shulley (1900-1956)

Frederick J. Shulley, 55, of Chambersburg, Pa., died January 14 after a long illness.

Born September 26, 1900, at Reading, Pa., Mr. Shulley was graduated from the old Pennsylvania State Forest Academy at Mont Alto in 1922, and obtained the M.F. degree at Yale in 1924.

His professional career included employment with the Ohio Division of Forestry and the Arkansas State Extension Service. During World War II, he served with the War Production Board, and subsequently was in Japan and Korea on land management work.

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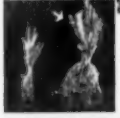

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Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of December are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of March 1, 1956. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

WEST VIRGINIA UNIVERSITY

Inks, D. F.

Junior Grade

Ayre, W. L., Res. Forester, Dept. of Forest & Waters, Harrisburg, Pa. Reinstatement.

Beatty, E. W., Dept. of Forests & Waters, Ligonier, Pa. Reinstatement.

Clark, H., 50 N. Munn Av., E. Orange, N. J. Reinstatement.

Drobile, R. J., 259 Dupont St., Philadelphia, Pa. Reinsttatement.

Harris, A. R., 514 Homestead Ave., Mt. Holly, New Jersey. Reinstatement.

Koch, C. B., 845 Willowdale Rd., Morgantown, W. Va. Reinstatement.

Reid, W. H., Div. of Forestry, W. Va. Univ., Morgantown, W. Va. Reinstatement.

Thomas, E. A., Box 390, Beckley, W. Va. Reinstatement.

Underwood, D. L., Box 117, Culloden, W. Va. Reinstatement.

Wilson, J. W., Dept. of Forests & Waters, Clearfield, Pa. Reinstatement.

Member Grade

Lyon, A. B., Box 682, Blacksburg, Va. Reinstatement.

Marra, J. A., Forester, W. Va. Cons. Comm., Summersville, W. Va. (Junior, 1949).

Shearer, F. W., Willow Hills, Pa. Reinstatement.

Wagner, J. F., Asst. Dist. Forester, Pa. Dept. of Forests & Waters, Fayetteville, Pa.; Pa. State, B.S.F., 1952. (Junior, 1952).

Appalachian Section

Student Grade

DUKE UNIVERSITY

Landgraf, A. E.

NORTH CAROLINA STATE COLLEGE

Gibbs, G. S.

Junior Grade

Arnold, J. W., 10 Coolbrook Lane, Greenville, S. C. Reinstatement.

Aulbach, J. J., Box 5, Blacksburg, Va. Reinstatement.

Baskerville, J. C., Box 171, Hickory, N. C. Reinstatement.

Carlson, A. E., Forester, W. Va. Pulp & Paper Co., Columbia, N. C.; Duke, M.F., 1952.

Connell, J. L., Forester, U.S.F.S., Highlands, N. C. Reinstatement.

Dallas, H. G., Carolina Power & Light Co., Raleigh, N. C. Reinstatement.

Ellis, C. W., Creed Apt., Camden, S. C. Reinstatement.

Faulkner, C. R., U.S.F.S., Murphy, N. C. Reinstatement.

Hichman, R. D., Cherokee Indian Agency, Cherokee, N. C. Reinstatement.

Penland, R. F., Box 7084, Asheville, N. C. Reinstatement.

Wheless, J. H., 602 S. Boylan Ave., Raleigh, N. C. Reinstatement.

Member Grade

Barick, F. B., Chief, Game Div., Wildlife Res. Comm., Raleigh, N. C. (Junior, 1949).

Boyce, J. S., Pathologist, S.E. Forest Expt. Sta., Asheville, N. C. (Junior, 1949).

Crider, P. F., Forester, International Paper Co., Jacksonville, N. C. (Junior, 1949).

Durham, G. V., Forestry Dept., Duke Power Co., Charlotte, N. C. (Junior, 1949).

Friend, E. A., Forester, Sheffield Lbr. Co., Suffolk, Va. (Junior, 1949).

Grist, R., Forester, Ritter Lbr. Co., Hallsboro, N. C. (Junior, 1949).

Herlevick, V. W., Consulting Forester, Wilmington, N. C. (Junior, 1949).

Hogan, J. J., Asst. Forest Mgmt., International Paper Co., Georgetown, S. C. (Junior, 1949).

House, D. T., Pulpwood Dealer, Halifax Paper Co., Louisburg, N. C. (Junior, 1948).

Jones, W. D., Forester, The Chesapeake Corp. of Va., West Point, Va. (Junior, 43R49).

Keppler, W. E., Asst. Supt., Draper Corp., Biltmore, N. C. (Junior, 48R55).

Millwood, C. E., Cons. Forester, International Paper Co., Camden, S. C. (Junior, 1949).

Olson, D. F., Research Forester, S.E. Forest Expt. Sta., Statesville, N. C. (Junior, 1949).

Rettberg, H. C., Sunset, S. C. Reinstatement.
Rodger, E. E., Asso. State Forester, Va. Forest Service, Charlottesville, Va. (Junior, 1949).
Rountree, C. C., Forester, S. C. State Comm. of Forestry, Orangeburg, S. C. (Junior, 1949).
Rumpf, R. H., Forester, Glatfelter Pulpwood Co., Fredericksburg, Va. (Junior, 1949).
Strawn, W. H., Forester, N. C. Natl. Forest, Lenoir, N. C. (Junior, 1949).
Tetterton, S., Forester, Sunny Hill Plantation, Camden, S. C. (Junior, 1949).
Tupper, M. W., Forester, N. C. Pulp Co., Plymouth, N. C. (Junior, 46R55).
Whitfield, F. E., Dist. Forester, N. C. Agric. Ext. Service, Asheville, N. C. (Junior, 1949).
Wicks, W., Chief Forester, Halifax Paper Co., Roanoke Rapids, N. C. (Junior, 1949).
Woodling, R. H., Forest Tech., Va. Forest Service, Portsmouth, Va. (Junior, 1949).
Yancey, T. E., Forest Tech., Va. Forest Service, Waverley, Va. (Junior, 1949).

Affiliate Grade

Hilmon, J. B., Range Cons., U.S.F.S., Raleigh, N. C.; Utah State, B.S. (Range Mgmt.), 1955.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Thomason, A. M. Underwood, W. L.

Junior Grade

Cress, L. M., Box 536, Granby, Colo. Reinstatement.
Grover, J. D., U.S.F.S., Halsey, Neb. Reinstatement.
Loerch, K. A., College of Agric., Lincoln, Neb. Reinstatement.
Paulsen, H. A., Rky. Mtn. Forest & Rge. Expt. Sta., Fort Collins, Colo. Reinstatement.

Central States Section

Student Grade

PURDUE UNIVERSITY

Chilman, K. C.

Junior Grade

Kennedy, G. E., 2105 S. 11th St., Ironton, Ohio. Reinstatement.
Kinder, M. T., Houghton Lbr. Co., Indianapolis, Ind. Reinstatement.
Stiles, H. E., Crab Orchard Natl. Wildlife Ref., Carterville, Ill. Reinstatement.
Walker, R. S., 12 W. Warren St., Calumet City, Ill. Reinstatement.

Member Grade

Brenneman, 348 N. Pine St., Decatur, Ill. (Junior, 1949).
Ott., C. A., Florence, Wis. (Junior, 1949).
Wade, R. V., Box 338, Thomson, Ill. (Junior, 1949).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Barr, G. E. Woike, L. R.

Junior Grade

Benecke, W. O., Umpqua Natl. Forest, Roseburg, Ore. Reinstatement.
Bergsvik, K., Forester, Bur. of Land Mgmt., Salem, Ore.; State Univ. of N. Y., B.S.F., 1952.
Boehme, K. R., 3050 Alder St., Eugene, Ore. Reinstatement.
Chamard, R. R., Rt. 3, Box 435, Corvallis, Ore. Reinstatement.
Guenther, K. W., Coast Industries, Coos Bay, Ore. Reinstatement.
Luthy, R. M., Resident Forester, Publishers' Paper Co., Oregon City, Ore.; Ore. State, B.S.F., 1951.
Sorsdahl, D. H., 330 S. 14th, Salem, Ore. Reinstatement.
Steers, I. A., U.S.F.S., Lowell, Ore. Reinstatement.
Underwood, B. H., Resident Eng., Weyerhaeuser Tbr. Co., Molalla, Ore.; Ore. State, B.S.F., 1948

Member Grade

Shull, W. A., Rt. 3, Box 176, Tigard, Ore. Reinstatement.

Affiliate Grade

Decker, H. L., Forester, Fremont Natl. Forest, Lakeview, Ore.; Ark. A & M, B.S., (Forestry), 1954.

Gulf States Section

Student Grade

LOUISIANA POLYTECHNIC INSTITUTE

Bottoms, J. W. Mullin, C. E.
Davidson, J. H. Nugent, J. A.
Dowling, P. G. Palmer, W. M.
Faircloth, C. A. Rowell, C. D.
Hollis, B. M. White, M. H.
Mety, M. P. Young, R. A.

LOUISIANA STATE UNIVERSITY

Richardson, R. W.

Junior Grade

Donaldson, D. J., 48 Kent Ave., Alexandria, La. Reinstatement.
Dronzek, J. J., Box 191, Houston, Miss. Reinstatement.
Lathrop, F. P., Fairlawn Farm, Weyanoke, La. Reinstatement.
Miles, D. J., 122 Calhoun Ave., Vazoo City, Miss. Reinstatement.
Patton, A. C., Box 472, Newellton, La. Reinstatement.

Member Grade

Byrd, J. W., 2927 Morrow Ave., Waco, Texas. (Junior, 1949).
Carlton, C. F., Parks Lbr. Co., Newellton, La. (Junior, 1949).
Cleveland, R. L., Box 831, DeQuincy, La. (Junior, 1948).
Davis, R. A., Cons. Forester, Champion Paper & Fiber Co., Huntsville, Texas. (Junior, 1949).
Dolhonde, P. E., 639 Richmond St., Bogalusa, La. (Junior, 1949).
Drews, R. J., 1019 Morton St., Jennings, La. (Junior, 1949).
Finnegan, J. E., 3819 Mobile St., El Paso, Texas. (Junior, 48R51).
Franklin, B. D., 524 S. Main St., Pasadena, Texas. (Junior, 1948).
Gipson, R. E., Chief Forester, Lutcher & Moore Lbr. Co., Orange, Texas. (Junior, 1949).
Goddard, R. E., Texas Forest Service, Alto, Texas. (Junior, 1949).
Koshi, P. T., S. Forest Expt. Sta., Stephen F. Austin State College, Nacogdoches, Texas. (Junior, 1947).
Nelson, K., Chief Forester, Southern Pine Lbr. Co., Diboll, Texas. (Junior, 1949).
Nugent, B. A., Dist. Ranger, U.S.F.S., Cleveland, Texas. (Junior, 1949).
Schulz, O. W., Box 43, Clarks, La. (Junior, 1949).
Sidney, C. T., Consulting Forester, Hammond, La. (Junior, 1949).
Suneson, V. C., Asst. Forester, Texas Forest Service, Conroe, Texas. (Junior, 1949).
Tannehill, R. M., Fisher, La. (Junior, 1949).
Trichel, J. S., Brown Paper Mill Co., Inc., Monroe, La. (Junior, 1948).
Wallace, R. J., Prof., Stephen F. Austin State College, Nacogdoches, Texas. (Junior, 1949).
Webster, J. B., Dist. Forester, Texas Forest Service, Conroe, Texas. (Junior, 1949).

Affiliate Grade

Miller, J. P., Wood Procurement Supv., East Texas Pulp & Paper Co., Kirbyville, Texas; Stephen F. Austin State College, B.S., (Forestry), 1954.
Thornton, C. S., Dist. Forester, Masonite Corp., Bay Springs, Miss.
Williams, D. L., Public Lands Forester, Miss. Forest Service, Wiggins, Miss.; Miss. State, B.S., (Forestry), 1955.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Fellows, L. A.

Junior Grade

Boyd, R. J., Forester, U.S.F.S., Spokane, Wash.; Colo. A & M, B.S.F., 1948; M.F., 1950.
Cochran, W. G., Box 522, St. Maries, Idaho. Reinstatement.
Gansel, C. R., Grad. Student, Univ. of Idaho, Moscow, Idaho; Mont. State, B.S.F., 1953.
Swisher, J., Asst. Ranger, U.S.F.S., Avery, Idaho; Colo. A & M, B.S.F., 1947.
Willson, R. P., 417 E. 17th Ave., Spokane, Wash. Reinstatement.

Member Grade

Finch, T. L., Asst. Ranger, U.S.F.S., Metaline Falls, Wash. (Junior, 1949).
Glades, K., Forester, Potlatch Lbr. Co., Potlatch, Idaho. (Junior, 1944).
Stubbs, J. W., Forester, Happ-DeWilde Tbr. Co., Pullman, Wash. (Junior, 40R52).
Watson, J. S., Asst. Ranger, U.S.F.S., Metaline Falls, Wash (Junior, 1949).
Williams, D. F., Blister Rust Staff, Clearwater Natl. Forest, Orofino, Idaho. (Junior, 1949).

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Intermountain Section

Student Grade

UTAH STATE AGRICULTURAL COLLEGE

Brockmann, D. D. — Shearer, R. C.
Hooper, J. F. — Silkorowski, P. P.
Murphy, J. L. — Warren, S. E.

Junior Grade

Herrington, R. B., 1060 Rancho Blvd., Ogden, Utah. Reinstatement.
Hill, W. C., Forester, U.S.F.S., Kearns, Utah; Utah State Agric., B.S.F., 1952.
Payne, R. W., 1331 22nd St., Ogden, Utah; Utah State Agric., B.S.F., 1955. (Student, 1954).
Ross, C. D., U.S.F.S., Mountain City, Nev. Reinstatement.

Member Grade

Leonard, R. B., Box 1089, Cedar City, Utah. Reinstatement.

Kentucky-Tennessee Section

Junior Grade

Anderson, R. G., Dist. Forester, Hawassee Land Co., Greeneville, Tenn.; Univ. of Fla., B.S.F., 1949.

New England Section

Student Grade

UNIVERSITY OF MAINE

Bassett, K. H. — Grundy, D. B.
Brown, R. B. — Morrill, W. J.
Fitzgerald, R. O. — Sanborn, R. M.
Gammons, R. L.

YALE UNIVERSITY

Blum, B. M. — Heist, L. C.
Daniels, J. P. — Mills, B. B.
Dierauf, T. A.

Junior Grade

Laurin, G. F., 89 Western Ave., Augusta, Maine. Reinstatement.
Locke, J. P., Colebrook, N. H. Reinstatement.
Steffens, J. D., University of Maine, Orono, Maine; Univ. of Maine, B.S.F., 1955. (Student, 1953).

Member Grade

Fitch, H. P., Consulting Forester, Groton, Mass. (Junior, 1940).
Hocker, H. W., Instructor, University of New Hampshire, Durham, N. H. (Junior, 1949).
Kiefer, G. C., Salisburg, Conn. (Junior, 1949).
Lynch, T. F., Dist. Forester, Mass. Dept. Natural Res., Ipswich, Mass. (Junior, 1949).
MacIntosh, M. B., Scaler Hollingsworth & Whitney, Bingham, Maine (Junior, 1949).
Mason, H. F. R., Forester, Peck Lbr. Co., Westfield, Mass. (Junior, 1949).
Orcutt, E. J., 10 Sargent Drive, Old Town, Maine (Junior, 1949).
Reifsnyder, W. E., 360 Prospect St., New Haven, Conn. (Junior, 1949).
Roggie, R. J., Scaler, Brown Co., Berlin, N. H. (Junior, 1949).

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Ayars, W. B. — Miller, R. W.
Davis, J. L. — Richards, N. A.
Denny, R. F. — Stolte, W. F.
Jurgensen, R. I.

Junior Grade

Lock, R. H., Box 231, Downsville, N. Y. Reinstatement.

Member Grade

Fonda, D. V., Representative, F. A. Bartlett Tree Expert Co., Oneida, N. Y. (Junior, 1949).

Northern California Section

UNIVERSITY OF CALIFORNIA

Student Grade

Bruni, R. L. — Schaefer, C. H.
Pesonen, D. E.

Junior Grade

Albertus, C. G., Box 1551, Monterey, Calif. Reinstatement.
Ellington, W. B., Forester, Wildwood Lbr. Co., Platina, Calif.; Univ. of Calif., B.S.F., 1952.
Froehlich, H. A., Box 111, Alderpoint, Calif. Reinstatement
Mendel, G., U.S.F.S., North Fork, Calif. Reinstatement.
Minter, B. E., Forester, U.S.F.S., Big Creek, Calif.; Univ. of Calif., B.S.F., 1950.
Toland, J. R. S., Box 342, Greenville, Calif. Reinstatement.

Member Grade

Akers, J. C., Forester, Diamond Match Co., Paynes Creek, Calif. (Junior, 1949).
Batchelor, T. H., 763 W. St., Redding, Calif. Reinstatement.
Belforte, C. R., Asst. Sales Mgr., Setler Forest Products, Sacramento, Calif. (Junior, 1949).
Denny, J. C., Forest Tech., Calif. Div. of Forestry, Redding, Calif. (Junior, 1949).
Dodge, J. M., Asst. Forest Tech., Calif. Div. of Forestry, Santa Cruz, Calif. (Junior, 1949).
Doe, E. S., 11009 O'Dell Ave., Sunland, Calif. Reinstatement.
Dotta, D. D., Forest Tech., Calif. Div. of Forestry, Benicia, Calif. (Junior, 1949).
Evans, G. G., Logging Supt., Hammond Lbr. Co., Samoa, Calif. (Junior, 35R50).
Fenner, R. L., Consulting Forester, El Sobrante, Calif. (Junior, 1949).
Henry, L. G., Forester, U.S.F.S., Greenville, Calif. (Junior, 1949).
Hill, G. B., Agriculturist, U.S.F.S., Placerville, Calif. (Junior, 1944).
Hobbs, S. M., 1508 S. 4th St., Alhambra, Calif. Reinstatement.
Holt, T. M., Forester, Bur. of Indian Affairs, Sacramento, Calif. (Junior, 34R48R55).
Hunt, B. B., Forest Tech., Calif. Div. of Forestry, Redding, Calif. (Junior, 42R54).
James, G. S., Asst. Regional Forester, U.S.F.S., Fairfax, Calif. (Junior, 1949).
Kincaide, G., Forester, High Sierra Pine Mills, Oroville, Calif. (Junior, 42R55).
Kuhn, R. M., Engineer, Rees Blow Pipe Mfg. Co., Inc., Oakland, Calif. (Junior, 1948).
Nicholson, J. A., Forester, Crawford Lbr. Co., Redding, Calif. (Junior, 43R55).
Petersen, E. F., 522 Henrahan, Porterville, Calif. Reinstatement.
Phibbs, G. O., State Forest Ranger, Calif. Div. of Forestry, Madera, Calif. (Junior, 1949).
Pirsko, A. R., Forester, Calif. Forest & Rge. Expt. Sta., Berkeley, Calif. (Junior, 1949).
Scholberg, C. B., Dist. Ranger, U.S.F.S., Sierraville, Calif. (Junior, 1949).
Sperry, R. D., Evaluation Engr., U. S. Bur. Internal Revenue, Corte Madera, Calif. (Junior, 1949).
Startt, C. F., Supt., Scott Lbr. Co., Inc., Burney, Calif. (Junior, 1949).
Stathem, P., U.S.F.S., Redding, Calif. Reinstatement.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Billheimer, C. S. — Rounds, J. A.

Junior Grade

Bollinger, D. A., Augusta, Mont. Reinstatement.
Gordon, W. W., Belt Creek Ranger Sta., Neihart, Mont. Reinstatement.
Heath, M. O., Forest Engr., J. Neils Lbr. Co., Libby, Mont.; Mont. State, B.S.F., 1951.
Martin, F. D., Forester, J. Neils Lbr. Co., Troy, Mont.; Mont. State, B.S.F., 1951.

Member Grade

James, C. L., 821 Brooks St., Missoula, Mont. Reinstatement.

Affiliate Grade

Hamor, C. K., Forester, J. Neils Lbr. Co., Libby, Mont.
Schoknecht, M. J., Asst. Logging Mgr., J. Neils Lbr. Co., Libby, Mont.

Ozark Section

Junior Grade

Fox, W. H., General Partner, W. S. Fox & Sons, Pine Bluff, Ark. (Affiliate, 1947).

Member Grade

Anderson, L. M., Helena Natl. Bank, Helena, Ark. Reinstatement.

Affiliate Grade

Hamer, R. H., Rt. 1, Wyandotte, Okla.; Okla. A & M, B.S., (Forestry), 1955.
Pruitt, W. D., Field Asst., International Paper Co., Murfreesboro, Ark.; Okla. A & M, B.S., (Forestry), 1950.

Puget Sound Section

Junior Grade

Hazelbaker, D. L., Creston, B. C., Canada. Reinstatement.

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Jacobsen, R. S., Dist. Ranger, U.S.F.S., Randle, Wash. Reinstatement.
Lausch, B. A., 220 E. 5th, Olympia, Wash. Reinstatement.
Morton, L. V., Adm. Asst., State Div. of Forestry, Olympia, Wash.; Wash. State, B.S., (Forestry), 1949. (Affiliate, 1951).
Roesler, O. J., Box 25, Sultan, Wash. Reinstatement.
Rust, W. J., Box 120, Anchorage, Alaska. Reinstatement.
Smith, R. L., 6735 Wildaire Rd., Tacoma, Wash. Reinstatement.

Affiliate Grade

Gormely, M. W., Forestry Consultant, 913, 207 W. Hastings St., Vancouver, B. C., Canada; Univ. of B. C., B.S., (Forest Eng.), 1929.
Lounsbury, E. R., Tbr. Cruiser, Cascade Lbr. Co., Yakima, Wash.
Rickey, R. A., Dist. Forest Warden, State Div. of Forestry, Port Orchard, Wash.
Taylor, A. R., Asst. Logging Supt., Cascade Lbr. Co., Ellensburg, Wash.
Thomas, S. L., Woods Foreman, Cascade Lbr. Co., Ellensburg, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Callaway, G. E. — Mason, R. K.
Donaldson, F. S.

Junior Grade

Boyd, E. F., Soil Cons. Service, Swainsboro, Ga. Reinstatement.
Brown, H. M., Land Surveyor, Gair Woodlands Corp., Savannah, Ga.; Purdue, B.S.F., 1940.
Childs, T. G., Douglas, Ga. Reinstatement.
Everett, C. M., Jeffrey-McElrath Lbr. Co., Macon, Ga. Reinstatement.
Johnson, W. R., Macon Kraft, Greensboro, Ga. Reinstatement.
Kemp, T. S., Box 124, Lumpkin, Ga. Reinstatement.
Kennedy, I. C., Pooler, Ga. Reinstatement.
Maxon, C. E., 505 First St. S., Cordele, Ga. Reinstatement.
Miller, M. L., Rt. 1, Stilson, Ga. Reinstatement.
Nixon, M. E., 192 N. Palm St., Jesup, Ga. Reinstatement.
Owers, G. R., Jr. Forester, Union Bag & Paper Corp., Savannah, Ga.; Univ. of Mich., B.S.F., 1953.
Seaman, J. D., 613 Montgomery Highway, Birmingham, Ala. Reinstatement.
Stanbery, F. W., Box 117, Okeechobee, Fla. Reinstatement.
Wike, C. O., 316 Judy Lane, Americus, Ga. Reinstatement.

Member Grade

Wright, H. R., Box 216, Blairsville, Ga. Restatement.

Affiliate Grade

Jones, M. B., Forestry Aide, U.S.F.S., Tallahassee, Fla.
King, J. F., c/o Langdale, Valdosta, Ga. Reinstatement.

Associate Grade

Foster, A. A., Plant Path., U.S.F.S., Macon, Ga.; Cornell Univ., B.S., (Plant Breeding), 1939; Ph.D., (Plant Pathology), 1945.

Southern California Section

Junior Grade

Gebben, R. A., 830½ Orange Grove Place, S. Pasadena, Calif. Reinstatement.
Hurt, T. L., 926 N. Garfield Ave., Alhambra, Calif. Reinstatement.

Member Grade

Coleman, G. B., U.S.F.S., Santa Barbara, Calif. (Junior, 1949).
Grace, H. D., Fire Control Officer, U.S.F.S., Duarte, Calif. (Junior, 40R54).

Southwestern Section

Junior Grade

Schuft, P. H., Grand Canyon Natl. Park, Grand Canyon, Ariz. Reinstatement.

Upper-Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Burdett, P. W. — How, D. C.
Holland, J. S. — Lorenz, P. R.

UNIVERSITY OF MINNESOTA

Ellison, F. E. — Kohrt, R. C.
Hegg, K. M. — Reinke, M. L.
Herbst, R. L. — Resman, W. A.
Holm, C. A. — Stone, N. S.

Junior Grade

Hamm, H. H., Dist. Forest Ranger, U.S.F.S., Deer River, Minn.; Univ. of Idaho, B.S.F., 1936.
Holland, J. S., 2917 W. Street, Ames, Iowa; Iowa State, B.S.F., 1955. (Student, 1955).
Lorenz, P. R., 1134 46th St., Des Moines, Iowa; Iowa State, B.S.F., 1955. (Student, 1955).
Ouellette, C. G., 1221 Irvine, Bemidji, Minn. Reinstatement.
Ter Louw, J. W., 121 Beech, Ames, Iowa; Iowa State, B.S.F., 1955. (Student, 1955).
Van Deusen, J. L., 2027 Pammel Court, Ames, Iowa; Iowa State, B.S.F., 1955. (Student, 1955).
Widmark, C. R., Forester, Park Region Tbr. Co., Brainerd, Minn.; Iowa State, B.S.F., 1950.

Wisconsin-Michigan Section

Student Grade

UNIVERSITY OF MICHIGAN

Beard, P. O. — Schneider, G.
Kincaid, H. R. — Schultz, J. D.

Junior Grade

Flink, C. F., 220 Iron Street, Norway, Mich. Reinstatement.
Gregory, C. W., 9142 St. Marys, Detroit, Mich. Reinstatement.
Howe, W. R., Forester, Escanaba Paper Co., Manistique, Mich.; Univ. of Mich., B.S.F., 1947; M.F., 1947.
Linebaugh, P. L., Asso. Forester, Dept. of Parks & Recreation, Detroit, Mich.; Mich. State, B.S.F., 1937.
Martin, J. L., Box 53, Baroda, Mich.; Mich. State, B.S.F., 1955. (Student, 1953).
McElroy, J. R., 1103 S. Lake Drive, Whitehall, Mich. Reinstatement.
Meyers, W. I., Supt., Dept. Parks & Recreation, Detroit, Mich.; Mich. State, B.S.F., 1923.

Member Grade

Morley, A. C., 514 Fifth Ave., Manistee, Mich. Reinstatement.

Affiliate Grade

Knapp, C. A., 135 Ahmeek St., Laurium, Mich. Reinstatement.

Associate Grade

Vaydik, Asst. Supt., Dept. Parks & Recreation, Detroit, Mich.

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Forestry News

Southern Conference on Woods Arson Called

Plans are under way for a Southern Forest Fire and Woods Arson Conference to be held in New Orleans, April 13-14, 1956. Its purpose will be to inform the public of the extreme seriousness of the woods arson problem in the southern states, arouse public opinion against those responsible for starting wildfires, and stimulate action to wipe out the arson menace.

Instigated by a resolution presented on October 4, 1955, at the annual meeting of the American Forestry Association by an array of southern forestry and forest industry groups, plans for the conference were endorsed by the Conference of Southern Governors at Point Clear, Ala., October 20th, 1955. (States represented: Ala., Ark., Del., Fla., Ga., Ky., La., Md., Miss., N. C., Okla., S. C., Tenn., Tex., Va., W. Va.)

Major southern forestry groups met in Atlanta, Ga., November 18 to map out details of the conference. Lowell Besley, executive secretary-forester of the A.F.A. was elected chairman of the conference. J. H. Kitchens, Jr., executive secretary of the Louisiana Forestry Assn., which will be the host organization for the conference, was elected secretary.

The conference is expected to attract more than one thousand persons. In addition to forestry industries, agencies, and organizations of the South, public officials and law enforcement officers will be in attendance.

Oregon State College Observes 50th Anniversary

Plans for a special March 3 observance of "Fifty Years of Forestry at Oregon State College" have been announced.

The all-day program will mark the fiftieth year that degree-granting work in forestry has been offered at O.S.C. Forestry classes date back to 1892 but the regular four-year program was established in 1906.

During the past 50 years, 1,411 bachelor's and advanced degrees in forestry have been conferred. The two living members of the first graduating class of four will speak at this year's observance. They are Harold D. Gill, Portland, and T. J. Starker, Corvallis.

The tentative anniversary program calls for morning and afternoon assemblies; open house at the school of forestry, the forestry cabin in McDonald forest, and the forest products laboratory; and an evening banquet.

At the assemblies, three early graduates will report on "50 years of development" in forest engineering, forest management and forest products—the three departments of the school of forestry.

Lynn F. Cronemiller assistant state forester and a 1914 graduate, will discuss developments in forest management; H. F. "Bert" Thomas, 1919 graduate, forest products developments; and L. L. "Stub" Stewart, 1933 graduate, forest engineering.

Albert Arnst, managing editor of the *Lumberman*, Portland, is alumni president. He will edit a special brochure marking the event. William A. Davies, head of forest engineering, is in charge of program arrangements.

Henry Clepper, executive secretary of the Society of American Foresters, will be banquet speaker. His topic will be "The Next 50 Years in Forestry."

Reservations for the dinner, which is expected to draw hundreds of former students back to the campus, can be sent to the school.

"Farmers" Defined for Louisiana Tree Distribution

A recent opinion handed down by the Attorney General's office in Louisiana defines who is eligible to receive

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state-produced pine seedlings for $0.50 per thousand. The opinion states, in part:

> People requiring forest tree seedlings can be placed in two categories, farmers, or people who own land not used for farming purposes. If the Legislature had intended that the definition of a farmer would include anyone engaging in forestry, then it was unnecessary to restrict the purchase of the forest tree seedlings at 50 cents per thousand to farmers.
>
> It is therefore our opinion that it was the intent of the Legislature that only a person owning land which is used for growing agricultural products as defined by the Legislature, and certified as such by the agricultural agent of the parish in which his farm is located, can purchase forest tree seedlings at a price of 50 cents per thousand.
>
> Those persons owning land which is not used for production of farm products cannot be classified as farmers and cannot purchase forest tree seedlings at the price fixed by the Act.

Boy Scouts Receive Rockefeller Grant for Conservation Program

The National Council of the Boy Scouts of America has received a grant of $50,000 from the Rockefeller Foundation toward support of a five-year program in conservation education, according to a recent announcement by Dr. Arthur A. Schuck, Chief Scout Executive.

Ted S. Pettit, who headed the 1954 National Conservation Good Turn, has been named to direct the new program.

The 1954 National Conservation Good Turn of the Boy Scouts, carried out at the request of President Eisenhower, resulted in widespread interest and activity by hundreds of thousands of Cub Scouts, Boy Scouts, Explorers, and their adult leaders. The organization plans to expand further its national conservation education emphasis in an effort to build on this interest created by the National Conservation Good Turn.

Georgia Launches Fire Prevention Crusade

A Forest Fire Prevention and Keep Green Conference held in Atlanta, Ga. in October drew an attendance of 1,000 persons. The conference was called by Governor Marvin Griffin and co-sponsored by the Georgia Forestry Association and the Georgia Forest Industries Committee. The intent of the conference was to inspire action on a local level to prevent forest fires, action which the Governor noted was necessary for the future prosperity of the state.

C. H. Stoddard Joins Resources For the Future Staff

Charles H. Stoddard of Minong, Wis., consulting forester and director of the Independent Timber Farmers of America, has been appointed to the land use staff of Resources for the Future. He will work with Marion Clawson, former director of the Department of the Interior, Bureau of Land Management, who heads research projects in land-use management for the organization. Resources for the Future, with headquarters in Washington, D. C., is sponsored and financed by the Ford Foundation.

Education

Schenck Professorship Established at North Carolina

The School of Forestry, North Carolina State College of Agriculture and Engineering, Raleigh, has announced the recent establishment of a $25,000 professorship known as the Carl Alwin Schenck Distinguished Professorship in Forest Management. Friends and alumni of Dr. Schenck's famous Biltmore Forest School, led by George W. Merck, created the professorship, whose first holder is Dr. T. E. Maki of the School.

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D. R. M. Scott Appointed to Washington Faculty

The University of Washington College of Forestry announces the appointment of Dr. David R. M. Scott as assistant professor of silviculture. Scott received his B. S. degree from the University of Virginia in 1942, M. F. and Ph.D. from Yale University in 1947 and 1950, respectively.

In 1950 and '51 Scott was with the Forestry Branch of the Canadian Department of Resources and Development, carrying on research in silvics and silviculture of lodgepole pine and white spruce. From 1951 through September 1955 he was with the Division of Research, Ontario Department of Lands and Forests, where he was in charge of research in silvics and silviculture. He is the author of articles in the JOURNAL OF FORESTRY, *Forestry Chronicle*, and *Forest Science*. His doctoral dissertation entitled "Amount and Chemical Composition of the Organic Matter Contributed by Overstory and Understory Vegetation to Forest Soil," was recently published by the Yale School of Forestry as Bulletin No. 62.

Short Course in Forest Photogrammetry

An intensive five-day course in the application and use of aerial photographs in forestry will be held at the College of Forestry, University of Washington, Seattle, March 12-16, 1956. The course will be directed to the forester and cruiser rather than the photogrammetric engineer.

The course will include:

Introduction to aerial photography; photo acquisition; photo specifications and contract agreement; basic elements of photogrammetry; forest photo interpretation techniques at present in use; forest inventory and statistics as applied to photogrammetry; transfer of detail from photos to base map; topographic mapping and control; working laboratory problems to illustrate lectures and demonstrations; and seminar and question period.

HUGH D. ANGLETON, graduate assistant in forestry at Purdue University, is receiving the $400 Joseph B. Knapp fellowship in wood utilization from Dean E. C. Young, Purdue graduate school. The fellowship fund was set up by J. Burke Knapp in memory of his father, Joseph B. Knapp, Purdue '04, successful western states lumberman, who was interested in fostering research in wood utilization. This is the first year that the award has been given. Angleton's study toward a Masters Degree, in the department of forestry, is directly related with the wood utilization program. He received his B.S. degree from Purdue in 1954.

Pulp and Paper Superintendents Award Scholarship

Richard A. Crumpler, third-year student in the School of Forestry at North Carolina State College, has been presented the third annual scholarship

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award of the Southeastern Division of the American Pulp and Paper Superintendents Association.

Announcement of the selection of Crumpler to receive the $200 award was made by Dr. Richard J. Preston, dean of the School of Forestry at State College.

Presentation of the award was made at a meeting of the faculty of the college's School of Forestry by T. R. Barnes of the Champion Paper and Fibre Company, Canton, N. C.

The Southeastern Division of the American Pulp and Paper Superintendents Association of which Barnes is chairman, established the scholarship award at North Carolina State College in 1953 as a means of promoting forestry in the area served by the Division.

Industrial & Private

Emanuel Fritz Honored at Western Conference

Emanuel Fritz, consulting forester for the California Redwood Association and professor of forestry, emeritus, School of Forestry, University of California, was presented with the 1955 Annual Western Forestry Award at the closing session of the Forty-Sixth Annual Forestry Conference of the Western Forestry and Conservation Association in Portland, Ore., on December 9. The plaque, is awarded each year in "recognition of distinguished achievement in the field of forestry."

Emanuel Fritz was professor of forestry at the University of California from 1919 to 1954 and has served as consulting forester for the California Redwood Association since 1934. He is a Fellow of the S.A.F., and past editor of the JOURNAL OF FORESTRY. In 1935, he organized the Redwood Logging Conference, which became the Redwood Region Logging Conference, of which he is executive-secretary, in 1948. He was an early member of the Save-the-Redwoods League and has served for years as one of their councillors.

L. J. Freedman Honored

Louis J. Freedman, president of the American Pulpwood Association, has received the New England Council's 4th annual Forestry Award for distinguished service in forest management. The citation came at the Council's 31st annual conference at which Raymond H. Trott, president of Rhode Island Hospital Trust Co., was elected council president.

Freedman is vice president in charge of woodlands for the Penobscot Chemical Fibre Co., Great Works, Maine.

Paul R. Kevin Joins Consulting Firm

After 31 years of service in public forestry, Paul R. Kevin retired on November 30 to accept a position with the firm of Hammond, Jensen and Wallen, consulting foresters of Oakland, Calif. At the time of his retirement Mr. Kevin was in charge of cooperative forest management in the Division of State and Private Forestry, California Region, U. S. Forest Service. Before transfer to the regional office in 1934, Kevin had served as ranger and timber staff officer on the Lassen, Plumas, and Stanislaus National Forests following early timber cruising assignments that, beginning in 1924, took him through most of the Modoc, Plumas, Stanislaus, and Sierra Forests.

K-T Forestry Co., Inc. Declares Dividend

The K-T Forestry Company, Inc., an organization of some forty foresters engaged in purchase and management of timber lands, declared a 5 percent stock dividend for each of the calendar years 1954 and 1955 which was paid December 31, 1955.

This company was organized in 1953 as the result of a study by a committee of the Kentucky-Tennessee Section of the SAF. The purpose of the company is to provide an opportunity for for-

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esters to participate in the ownership, management, and operation of forest land. Most foresters have insufficient funds to acquire and operate forest lands on their own. However, the committee thought that by pooling the resources and skills of a group of foresters, it would be possible to provide such an opportunity otherwise not available.

The company has purchased 600 acres and is acquiring 150 acres more in Bell County, Kentucky. Harry Nadler of Pineville, Ky., is company president, J. W. Lehman, Norris, Tenn., treasurer.

Robert Forbes Joins Canadian Publication

Robert H. Forbes, Moscow, Idaho, joined the editorial staff of the *British Columbia Lumberman* on January 2. Forbes is a forester who has for a number of years been engaged in free lance writing on forestry subjects. He will make his headquarters in Vancouver, B. C. in connection with his new position.

St. Regis Man Heads Florida Forestry Association

Meeting in Gainesville in December, the Florida Forestry Association went on record as endorsing a long range forestry program for the state and re-elected its officers and directors. Aims of the program, that had been developed by the Florida Forestry Council, are to bring about state-wide fire control, undertake a study of forest land tax problems with a view to equalization on a state wide basis, give impetus to training on both professional and subprofessional levels in forestry, and continue to sponsor research work in forest genetics at the University of Florida. Justin R. Weddell, St. Regis Paper Co., Pensacola, is president of the association. Charles G. Geltz, of the School of Forestry, Gainesville, is secretary.

Northeast A.P.A. Engineer Appointed

Effective December 1, James S. Hensel was appointed northeastern logging engineer for the American Pulpwood Association, according to L. J. Freedman, A.P.A. president.

Hensel had been assistant professor at the New York State Ranger School at Wanakena since 1946, with experience prior to that year in pulpwood procurement and operations. Hensel is a graduate of the Ranger School and holds a B.S. in Forestry from the University of Michigan and a masters from the State University of New York.

New Consulting Firm Announced

Commercial Foresters, Inc., with headquarters in Asheville, N. C., has been organized to furnish professional forestry services in that area.

Richard A. Wood, Thomas A. Hudgens, and Harvey R. Price are the principals in the new company. These three men are graduate foresters and members of the S. A. F. They bring together more than fifty years of combined experience, most of which was acquired in the Southern Appalachian region.

Price and Hudgens will devote their full time to the new venture while Wood will retain his present connection with Gordon Lumber Company, Inc., of Asheville, and give only part time to the new firm.

Their aim is to furnish a complete professional service to landowners and

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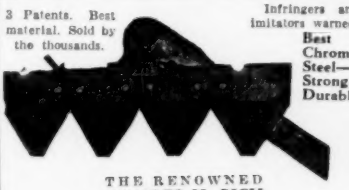

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With Excellent Performance

HALE Portable Pumping Units

	U. S. Gallons Per Minute	*Disch. Press. Lbs. Per Sq. In.*
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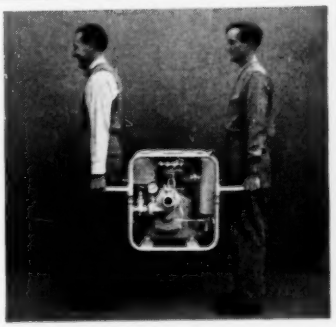
	100	70
FZ	50	60
	300	10
HPZF	15	200
	45	100

These 3 Centrifugal pumping "Workhorses" provide a remarkable range of volumes and pressures for efficiently fighting a wide variety of fires. All three units are conveniently portable by two men; can be easily mounted or carried on any type of apparatus or truck for fighting fires while in motion from booster tank; often used to pump from



inaccessible water source into major pumper, or to fight fires direct through long line of hose.

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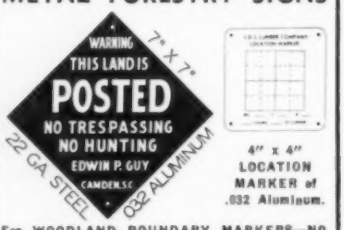

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forest industries covering the entire field from reforestation and land management to the harvesting and marketing of forest products. Particular emphasis will be placed on their knowledge of the Appalachian hardwoods although their field of operation will not be limited.

Allied

Save-The-Redwoods League Plans Expanded Program

At the annual meeting of the Save-the-Redwoods League held recently in San Francisco, Arthur E. Connick was re-elected president of the League for the ensuing year. Elected to the board of directors of the League, besides President Connick, are Dr. Ralph W. Chaney, William E. Colby, Francis P. Farquhar, Dr. Caryl P. Haskins, Edward Hohfeld and Charles P. Howard. Gerald H. Hagar was elected as a new member of the board of directors. Dr. Robert Gordon Sproul, University of California, is treasurer of the League, and Aubrey Drury is administrative secretary.

The membership of the League is now 18,000, it was reported at the meeting, but it was emphasized that additional members are desired to help carry out the League's program of forest preservation, including the Avenue of the Giants, Humboldt County, California.

A.F.A. Elects Directors

Karl T. Frederick, chairman of the board of the New York State Conservation Council, and a director of A.F.A. since 1937, has been reelected to serve as a director of A.F.A. for the 3-year term beginning January 1, 1956. New members of the board for the same period are Charles A. Connaughton, regional forester, U. S. Forest Service, California; George L. Drake, forestry consultant, Washington; DeWitt Nelson, director of natural resources, California; and Henry Schmitz, president, University of Washington. Other members of A.F.A.'s board and the year of expiration of their terms are as follows: Stanley G. Fontanna, School of Natural Resources, University of Michigan (1956); David V. Hagenbarth, Montana (1957); Mrs. Katharine Jackson Lee, New Hampshire Natural Resources Council (1957); George W. Merck, New Jersey (1956); Robert W. Sawyer, Oregon (1957); H. B. Shepard, Massachusetts (1957); Philip W. Smith, Pennsylvania (1957); Edward P. Stamm, Oregon (1956); James J. Storrow, New Hampshire (1956); George O. White, Missouri (1956).

Second National Watershed Congress Held

Some 300 persons participated in the Second National Watershed Congress, held in Washington, D. C., December 5-6. Primary interests of the delegates were in seeking ways and means for developing local support for watershed development, facilitating application of federal aid, and comparing on-the-ground progress of local watershed projects.

B.C. Man Heads Western Forestry

John E. Liersch, Powell River Co., Ltd., Vancouver, B. C., was elected president of the Western Forestry and Conservation Assn. at its 46th annual conference in Portland, Ore., December 7-9. He succeeds Emmit R. Aston, Biles-Coleman Lumber Co., Omak, Wash. George C. Flanagan, Elk Lumber Co., Medford, Ore., was elected first vice president.

Midwestern Shade Tree Conference

The 11th annual meeting of the Midwestern Chapter of the National Shade Tree Conference will be held February 22-24, 1956, in the LaSalle Hotel, Chicago, Illinois. The purpose of the organization is to encourage the planting of more trees and ornamental

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shrubs, to raise the standards of tree care practices by dissemination of knowledge gained through laboratory research and field work and to promote more friendly cooperation among those engaged in arboriculture. Membership is composed of commercial arborists, city foresters, park personnel, nurserymen, educators, research scientists, and others interested in the propagation and care of trees and shrubs.

The program is primarily directed to discussion of problems of concern to those who perform tree work in the midwest, but included also are topics of interest to arborists from all sections of the country.

Public

New Service to Georgia Industries

Rufus H. Page, jointly employed by the Southeastern Forest Experiment Station and the Georgia Forestry Commission, has commenced a cooperative program of forest utilization research in Georgia. He will be located at the Georgia Forestry Center, near Macon.

A graduate of North Carolina State College in 1935 with a B. S. in forestry, Page has served as assistant extension forester for North Carolina, extension forester for Alabama, supervisor of the Bladen Lakes State Forest in North Carolina, as a consulting forester and pulpwood dealer, and procurement forester for paper and fiber concerns. He served 5 years with the U. S. Navy during World War II.

Page will devote considerable effort to ways and means of utilizing the less marketable hardwoods. He will also serve as the U. S. Forest Service and Georgia Forestry Commission liaison representative between Georgia timber industries and the Forest Products Laboratory at Madison, Wis., bringing research results to industry and relaying research problems to the Laboratory for study and solution.

W. H. McComb, assistant state forester of Georgia, and Page are developing plans to contact smaller sawmills in an effort to begin a program of sawmill improvement to reduce mismanufacture of lumber and to develop more efficient cutting practices and profitable utilization of slabs, edgings, tops, and other products now considered waste.

State Forester Honored for Service to S. C. Agriculture

State Forester Charles H. Flory was selected by *The Progressive Farmer* as Man of the Year in Service to South Carolina Agriculture. Each year since 1937 this leading publication in southern agriculture has honored men "whose devotion and contributions to agriculture have gone far beyond the line of duty." In announcing the award in its January 1956 issue, *The Progressive Farmer* listed Mr. Flory's contributions to South Carolina agriculture in forest fire protection, help and advice for good forestry practices, reforestation, and the improvement of the state park system, all under Mr. Flory's admininistration of the Forestry Commission's programs.

CHARLES H. FLORY

Supervisor Appointed for Custer National Forest

William J. Lucas, assistant supervisor on the Sawtooth National Forest, Twin Falls, Idaho, has been appointed as supervisor of the Custer National Forest, with headquarters in Billings, Mont., according to Regional Forester

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Little Beaver Tree Girdler, cuts girdle around tree at walking speed. One man will girdle more acres per day than several men using other methods.

Brush and Pruning Saw attachments to take care of any brush cutting or pruning job. four foot sections may be added to get desired height. Brush saw does the work of several men.

A Post Hole Auger designed for one man operation. doing the work of heavy equipment diggers, holes quickly and easily made in any soil type. Wood auger may be attached for wood drilling.

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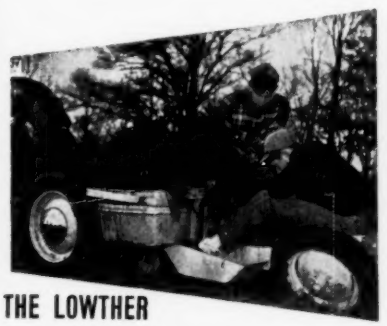

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P. D. Hanson.

Lucas graduated from the School of Forestry, University of Idaho. He began work in the Montana-Idaho Region of the Forest Service as range examiner in 1937. Following his appointment as district ranger on a Wyoming forest in 1941, he spent four years in military service.

Upon his release from the Army, he served as ranger on the Salmon Forest and as assistant supervisor on the Sawtooth. He has also completed numerous special assignments in range management work.

Mr. Lucas succeeds Frank Curtiss who was transferred to the regional office in Missoula.

Portland Forester Transferred to Denver

Virgil R. Carrell's transfer from the Pacific Northwest Region of the Forest Service at Portland, Ore., to head the timber planning activities in the Timber Management Division at the Denver Regional Office has been announced by Regional Forester J. Herbert Stone. In the new assignment, which was effective December 4 Carrell will be in charge of timber inventories, planning of timber harvest, and forest planting programs on the national forests of the Rocky Mountain Region in Colorado, Wyoming, and South Dakota.

For the past three years Carrell has been assistant to the chief of the Information and Education Division in the regional office in Portland.

Carrell graduated from the University of Washington College of Forestry in 1937. In 1946 he became district forest ranger on the Clackamas Ranger District of the Mt. Hood National Forest. Here he had charge of planning and executing timber disposal which became the largest in volume of any national forest ranger district in the United States. For his work he was selected, in 1949, to receive special recognition from the Secretary of Agriculture as the outstanding forest ranger of the year.

U.S.C.S.C. Announces Northwest Positions Open

The Northwest Board of U. S. Civil Examiners has announced an unassembled examination for Forester, GS-7, $4,225 per year, for employment by the Bureau of Land Management and the Bureau of Indian Affairs, Department of the Interior, for duty in the states of Oregon, Washington, Idaho, Montana, and in the Territory of Alaska. Civil Service Form 57 and card Form 5001-ABC, necessary for application, may be applied for at any post office. Completed applications are to be forwarded to the Executive Secretary, Department of the Interior Northwest Board of U. S. Civil Service Examiners, 1001 N.E. Lloyd Boulevard, P.O. Box 3537, Portland 8, Ore. Further information may be secured from this Board or from: Eleventh U. S. Civil Service Region at either Loussac-Sogn Bldg., Anchorage, Alaska; or 302 Federal Office Bldg., Seattle 4, Wash. The examination is open indefinitely.

Products & Equipment

I. E. L. Power Saw

One of the problems that operators face in using an ordinary chain saw is the lack of throttle response when the position of the saw is changed. In the improved model (HM) of I. E. L. power saws "Little Buz," this fault has been eliminated by using a modified Tillotson diaphragm carburetor and an I. E. L.-engineered fuel pump. Field reports show instant operating response, no matter in what position its full 5 horsepower engine is used. The 24-lb. HM eliminates the backstream of sawdust by a new style protective metal strut which stops the back flow of sawdust and directs it downward away from the face of the operator.

The Model HM also is designed with a raised gas tank aperture to prevent foreign matter being washed into the gas tank. The lack of pressurization in the gas tank eliminates leak or weepage from the gas tank cap.

The manual type oiler, standard equipment on the Model HM, is raised at the rear portion of the casting to enable the employment of a funnel when filling. The oiler control is situated in a handy position so the oil flow can be controlled without having to release the throttle. An optional accessory is an automatic oiler which can be installed easily.

Improvements include: smaller-sized radiused step plate, shut off switch close to operator's index finger, one piece solid cast gas tank and cowling, modified safe exhaust manifold and improved reed valve held by a new O ring. Another feature of the Model HM is the spark plug guard which guards against any possible shock to the operator. Cutter attachments are available in 18" to 32" lengths.

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This D9 is assigned to 25 miles of new road construction for Collins Pine Co. The outfit is 100% Caterpillar-powered in the woods. Says Logging Superintendent J. E. Garrett: "We get top performance from our Caterpillar-built units in any kind of weather and all conditions. During the winter months, we regularly log in 5 feet of snow with them."

286 HP **CAT*** D9 Tractor with No. 9A Bulldozer picked by Collins Pine Co. to pioneer in rough going

You're looking at a 73,000-pound D9 (as equipped) pioneering a logging road for Collins Pine Co., northeast of Chester, Calif. In many spots, the D9 pioneered work on 40-45° slopes. With its 286 HP heft, it handled material from rocky patches to boulders, maintaining a steady 8-hour-a-day, 5-day-a-week pace.

As big and rugged as the D9 is, it is also easy to operate. Here are some reasons why:

- **Hydraulic boosters provide power steering *and* braking.**
- **Long 7-roller track frame improves stability, flotation and ride.**
- **"In-seat" starting with single lever control insures fast starts in any weather.**
- **Adjustable seat, all-round visibility and easy access to all controls make the operator's job simpler.**

All in all, from its completely new 286 HP Caterpillar Engine to its tough "water-quenched" track shoes for longer wear, the D9 is built to set new production standards in the woods. The first track-type tractor with a turbocharger, it is available with torque converter or direct oil clutch drive, so you can match the drive to your job needs. Ask your Caterpillar Dealer to show you how it can step up your production!

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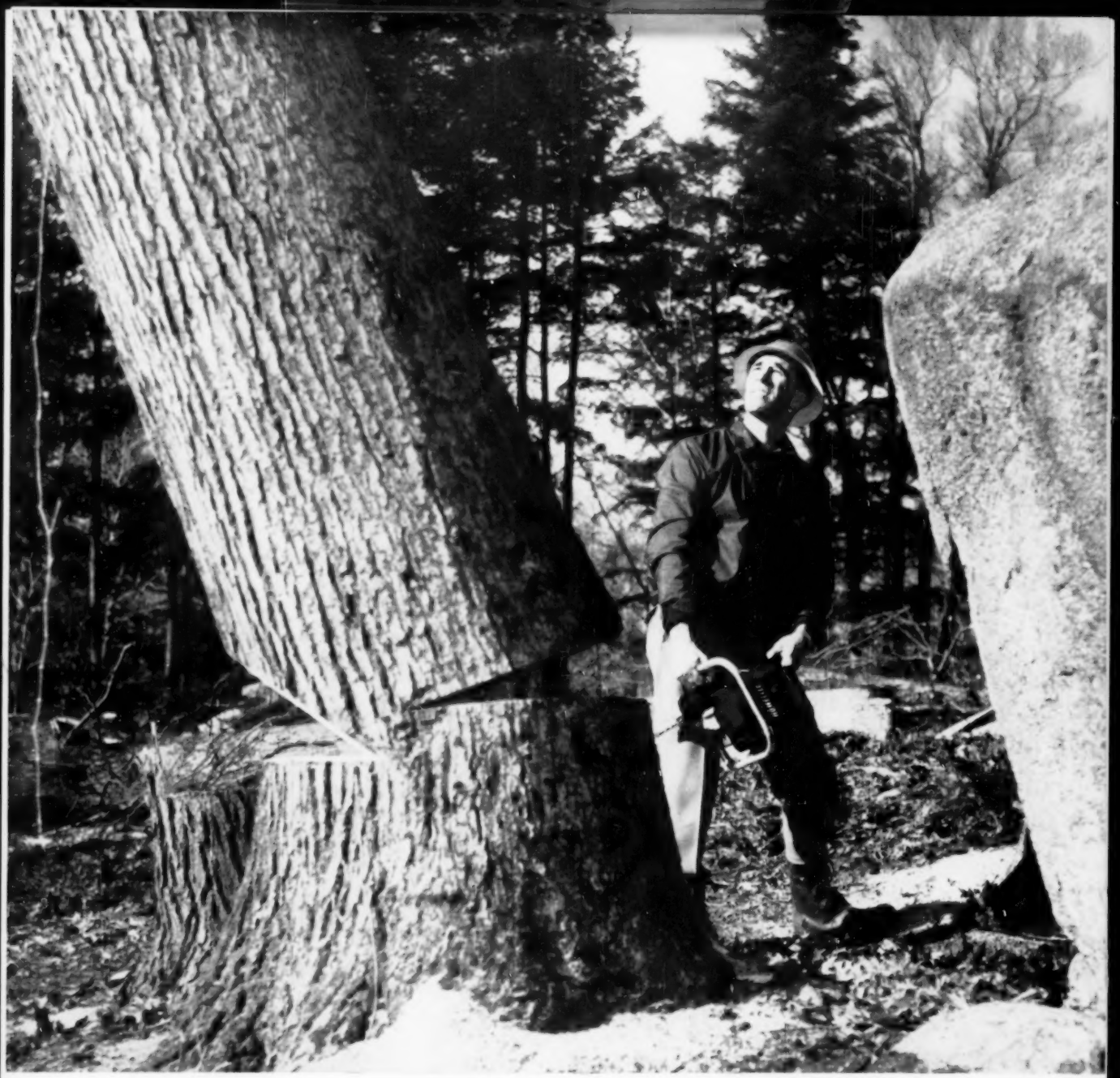

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